

# SCALE IN LITERATURE

WITH REFERENCE TO THE NEW TESTAMENT  
AND OTHER TEXTS IN ENGLISH AND GREEK

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# Abstract

This dissertation explores "scale" in literature in general, and in the New Testament epistles in particular. All creative activity has its locus at an appropriate point within a wide **scale** spectrum: literature is no exception. This became apparent in 1965 when scale relationships were observed by the author in cumulative sum graphs of the Pauline epistles. Such scale differences are familiar to architects who use scale as a creative tool, but a wide search through standard reference books, surveys of work on statistical stylometry, linguistics and Biblical studies failed to provide any evidence that scholars were aware of scale in literature.

Further investigation revealed that scale differences were to be found in many fields of creativity, in architecture, art, photography, music and engineering. Also explored was an interesting parallel found in the multi-layered scaling associated with the mathematics of chaos.

To provide a broader perspective through which to view the Pauline epistles, 80 works by six modern authors and the writings of three ancient Greek authors were selected as test material. Graphs were prepared showing the sentence sequences and distributions of these works comprising over 400,000 words, and scale differences were found, not only between works, but also between sections of individual works. These were related to differences in genre, and this raised serious questions concerning the statistical homogeneity of samples containing scale differences. Care was taken to relate patterns directly to the content of the text and to the findings of Biblical scholarship.

Links with theology revealed that the sense of the numinous presence, and the sense of the sublime in art, were on occasion directly reflected in sentence length. Human moods and feelings were found to have unpredictable but measurable manifestations in terms of scale in literature.

The Pauline epistles revealed a common scaling structure of varying degrees of complexity, and a mathematical model was devised to demonstrate that major parts of all thirteen epistles share similar unusual scaling features. Significant patterns of a different kind were also found covering the texts of Hebrews and substantial portions of 1 and 2 Peter. It is submitted that these patterns provide new hard evidence which must be considered together with the evidence from other sources in arriving at conclusions concerning the authorship of the New Testament epistles.



## **Declaration**

This dissertation is my own composition, and the research reported herein is entirely my own work.

George K. Barr

## Preface

The traditional method of approaching questions regarding the authorship of New Testament epistles has been through linguistic and literary studies. In the past thirty years, however, stylometric research based largely on statistical science has developed growing momentum. Between the two approaches there has been something of a gulf. Not many scholars in the linguistic and literary tradition have made use of computational and graphical techniques. Not many statisticians have given close attention to the genre and content of the texts, and statistical studies have been based upon the assumption that many linguistic features occur in a more or less random pattern. However, this is certainly not true of sentence length patterns which have a different kind of consistency, and which can provide a useful indicator of scale. I have found no evidence that either statisticians or linguists have recognised and quantified the effects of scale.

This present study attempts to explore the middle ground which lies between these two approaches. On the one hand, graphical methods are used and developed in new ways in a careful analysis of the sentence structure of the Pauline and other epistles; on the other hand, close attention is paid to the content and genre of the texts. Above all, scale, which is ubiquitous but hitherto unrecognised in literature, is explored.

The linguistic and literary approach is humanistic and recognises that literature is largely a matter of design, reflecting the creativity of the author, yet many of the patterns which authors produce are hidden, and must be brought to light by graphical means. The statistical approach is less humanistic, tries to reduce the subjective element of judgement as far as possible, and has its starting point in the observation of the laws of probability - or chance.

There is a fundamental difference between Creation and Chance.

This essay is a study in creativity. It must be made clear at the beginning that it is not a study in statistical stylistics, and although use is made of cumulative sum charts, these are developed in new ways. Statistical methods are not employed in these studies, and recent research in statistical stylometry is referred to only because statisticians have already been operating in the field of stylometry, producing findings which are in conflict with my own. My disciplines are principally architecture and divinity, but I also bring practical experience of other subjects, the most relevant of which are preaching and writing. The study is deliberately multi-disciplinary because scale transcends all disciplines and cannot be fully described in terms of any single discipline.

The presuppositions which underlie this study are quite different from those of statistical method. Statistical science begins with the observation of laws of chance. It forecasts the probability of events occurring on the basis of past experience of the laws of chance. This essay is concerned with creativity, which must include the creation of new events *ex nihilo* - an area which may be inaccessible by statistical methods.

Those following the statistical approach aim to detect differences which are greater than might be due to random sampling error, and to assign these differences to other factors such as genre or authorship. There has, however, been too great a readiness to attribute such deviations to differences in authorship, and although some attention has on occasion been given to factors such as genre, others, like scale, have remained unexplored. But when literature is considered as a creative art form, then it is seen to take place within the scale spectrum, and correspondences can be seen between works which lie at different points in the scale spectrum - correspondences which are not detected by statistical methods. Authors' works can be seen to cover a range of scales, with common patterns appearing at different scale levels.

Statistical method therefore is based on the laws of chance: this study is concerned with principles of creativity. Creation and Chance provide very different starting points.

Whenever the attempt is made to cover new ground in research, problems of terminology inevitably arise. Events previously unrecognised have to be described. As it is expected that the subject of scale in literature will eventually interest linguists, statisticians, and Biblical and other scholars, I have tried to avoid esoteric language and to use words in a basic way. It has not been possible to avoid an occasional term which is associated with a particular discipline, like the term "numinous" in theology, but these have been kept to a minimum. In the process of research, terms had to be invented to describe new features: most of these have been dropped, but no alternative could be found for one, namely, the "prime pattern" (page 148). The penalty for attempting to keep language simple is that it may be found wanting by experts in any particular discipline, and in this regard I ask for understanding.

The term "scale" has posed the greatest problem. From various points of view, it might be defined in a sentence, yet a comprehensive definition is not possible. Instead of attempting the impossible, this dissertation seeks to uncover successive layers of meaning. One might compare Paul's use of the term ἀγάπη (love) which likewise might have been defined in a sentence; however, it took a whole ministry and the New Testament epistles to clothe the term with rich connotations.

In this study new ground is being explored. This in itself is a creative exercise, and requires new methods which must be derived from the material being studied. Much use is made of graphs tracing the cumulative sum of variations from the average. Such graphs have been used in stylometry for many years, but new applications are developed herein. It must be explained that different kinds of graph are employed. Graphs with full apparatus are provided in the detailed examination of the epistles in Chapters 5 and 6. Other graphs are in the nature of illustrations, the point of which is indicated in the text. Most of these are small reproductions of tracings of large drawings and cannot carry full apparatus. For example, the little illustration of 1 Corinthians on page 194 was derived from an original drawing measuring a metre and a half in length. Collages of graphs in which a dozen are superimposed would require a dozen sets of scales, which cannot be meaningfully included in one drawing. The degree of detail provided is therefore suited to the purpose which each graph serves: some illustrate only one point and require no technical apparatus, while others require full sets of

scales.

Bibliography on the subject of scale is almost non-existent. The reading list given is eclectic, drawing from diverse sources, reflecting the all-embracing nature of scale. References in the text are noted in square brackets corresponding to the numbered bibliography in the end pages.

Conclusions are generally valid in terms of the discipline which has been followed and the extent of the test material which has been investigated. In the past, difficulties have arisen in the study of the New Testament texts through claims, either explicit or implicit in the presentation, that the results of research within one particular discipline have a universal application. In this study, the results are presented in terms of the test material which amounted to some 423,000 words, providing new, hard evidence to be added to that already available through other disciplines. Nevertheless, despite the limitations imposed by the restricted area of the test material, these conclusions may be of importance to ministers of the Gospel, because it is essential that a minister should have a working hypothesis regarding the scriptures of the New Testament. As a student in 1965 I was able to carry out the preliminary studies which are developed in this dissertation. On the basis of these, I entered the ministry with the conviction that a common scaling system was present covering substantial parts of most of the thirteen Pauline epistles. The Pastoral epistles showed evidence of displacement of some kind, and there were unsolved problems regarding punctuation. But I felt sure that what I had discovered at that point was enough to link closely the Romans/Galatians group and the Ephesians/Thessalonians group. This was important for my understanding of Pauline theology, and also for building up an appreciation of the person of Paul. Over the years, details would fall into place. The problem of Hebrews and the Petrine letters remained unsolved, although tantalising similarities had been noted. My conclusions therefore take the form of modifications to the working hypothesis which has served me, with periodic revision, throughout my ministry.

## Acknowledgements

I gladly acknowledge that my first interest in stylometry was kindled by an encounter in 1965, through book and lecture, with the Reverend A.Q. Morton. Without that initial stimulus, these studies would not have begun. During my student years in Trinity College, the late Professor William Barclay took great interest in my research and encouraged me to consider postgraduate studies.

However, the parish ministry claimed priority. During my years in Viewpark Church, Uddingston, notes were constantly added to the file. A fruitful source of challenging thought was my Bible Study group, members of which kept on asking awkward questions. I owe much to these friends with whom I explored Scripture, and especially to Mrs. Mina Macis who once smiled her irrepressible smile and said, "Mr. Barr, it's your job to **tell** us who wrote Hebrews" - whereupon I resolved to do my best to find out who did.

When the opportunity came to resume studies, the Reverend Ainslie McIntyre and Dr. Mike McMahon listened kindly and found my subject sufficiently promising to encourage me to proceed.

Returning to University circles after a long absence requires a mental gear change, but it proved to be a rewarding experience. I have appreciated the gracious way in which I was accepted in New College by Professor O'Neill, the staff and the students, and the stimulation of kindly argument and delightful fellowship which I found there. I am grateful especially to Dr. David Mealand who revealed scholarship of which I was blissfully unaware, and who wrestled patiently with papers written in terms of an alien discipline.

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## List of Abbreviations

ASL	Average sentence length
CS	Cumulative sum
FSS	Full stop sentence
MFSS	Modified full stop sentence
MSS	Manuscripts
MVA	Multivariate analysis
RSV	Revised Standard Version
UBS	United Bible Societies

# CHAPTER 1

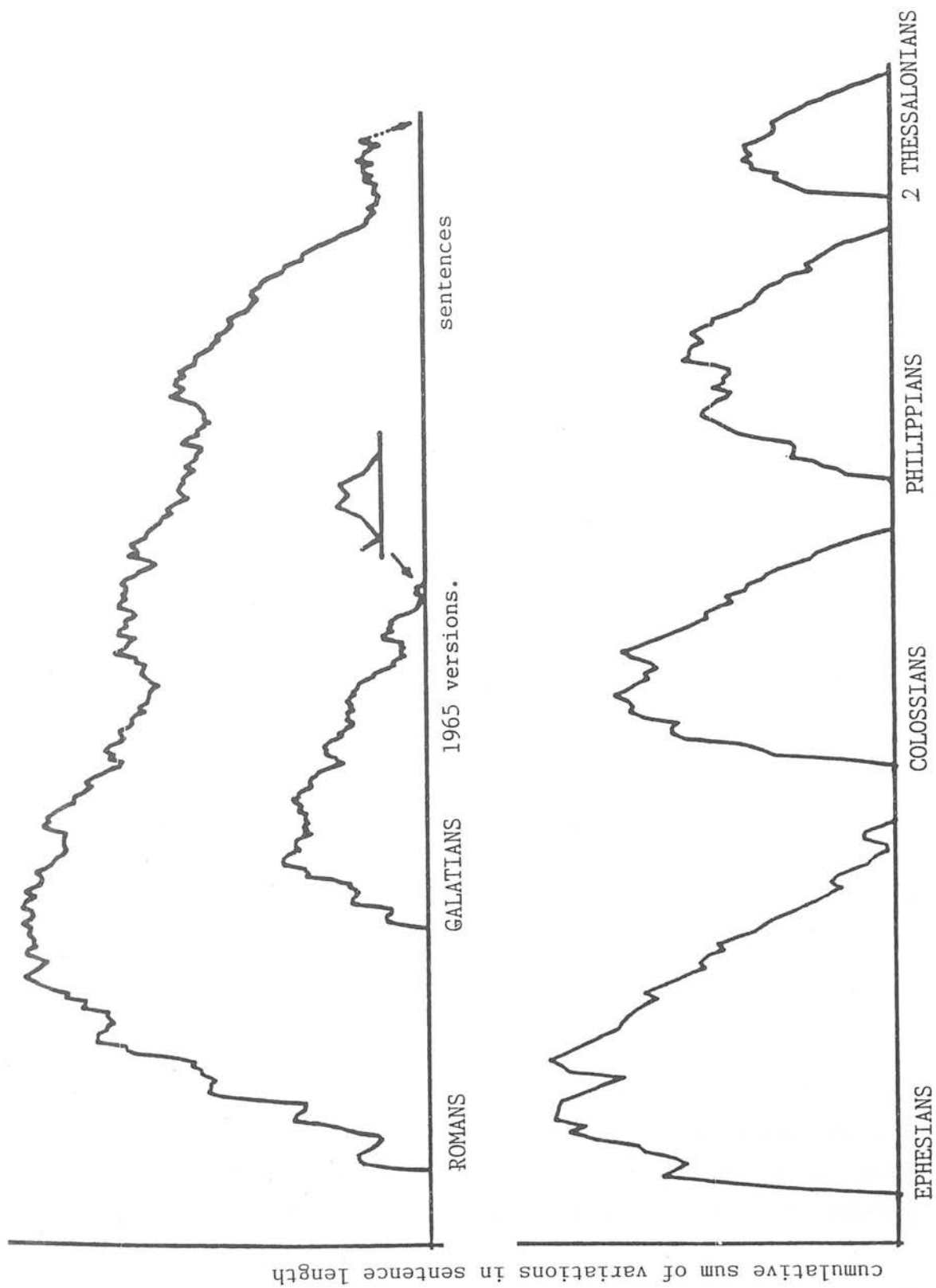
## Introduction

The purpose of this dissertation is the exploration of scale in literature generally, but the main interest lies in the discovery of scaling effects in the New Testament epistles and the questions which this raises for New Testament scholarship. It is customary to begin such a dissertation with an overview of work already carried out in the field but in this area bibliography is virtually nonexistent. The indexes of innumerable reference books failed to reveal any mention of scale in the sense in which it is understood for the purposes of this study. Several textbooks on design principles in architecture yielded direct evidence concerning the nature of scale, which is used in that profession as an everyday working tool. Hints were also detected in writing about music, though references were seldom explicit. Literature was explored in the field of statistical stylometry, particularly with regard to sentence length and recent statistical studies of the New Testament; also in linguistics regarding the nature of the sentence and recent theories concerning syntactical construction. The new mathematics of chaos with its inherent scaling system demanded that a comparison be made with scale in literature. Some useful links were found between scale and theology, and throughout these studies, care has been taken to relate new data to the established work of New Testament scholars. The most important of these references are noted in the bibliography.

We are venturing into unexplored territory, but this study has its roots in an encounter with A.Q. Morton's book, *The Authorship of the Pauline Epistles - A Scientific Solution* [47] which I read in 1965 when I was a

divinity student in Glasgow. This was the first time I had come across the application of statistical methods to literature, and a brief outline of the work which I did at that time will help to clarify the purpose and direction of this present study, and will show why I was unable to accept Morton's findings.

My work in 1965 was done with the sole purpose of clearing my mind regarding the authorship of the Pauline epistles in the face of imminent examinations. At that time I did not have the benefit of a computer but I drew some graphs plotting the cumulative sum of variations in sentence length in some of my student essays and found that there were indeed patterns showing recurring features which might have a bearing on authorship. I proceeded to do a hand-count of sentence length in all the New Testament letters, determining the average sentence length (ASL), and for simplicity in working out the cumulative sums, taking the nearest whole number as the average. The drift from the true average was then corrected graphically. Recurring patterns began to show in several letters. Punctuation caused a problem. I was using Souter's text and became aware that frequently the punctuation created sentences which did not appear to be "in scale" with their context. They seemed to interrupt the natural flow of the text, either by being too short and abrupt, or by being unduly sustained in length. (A full exploration of what is meant by scale in this respect is made in Chapter 4.) Experiments were made in adjusting the weight given to colons, full stops and question marks, but in the time available a rational system giving due respect to scale could not be found. The shortest possible groupings were tried, as were the longest. The latter appeared to give more consistent results. I then divided the text in an entirely subjective way in the manner which seemed to me at the time to reflect the element of scale most faithfully. It appeared to me that there was inherent in the text a pattern of mental pauses created subconsciously by the author, a pattern which no method of text division had yet revealed with precision. The sentence pattern was affected by later conventions of grammar, by corruption of various sorts, by personal preferences of editors and their tendency to simplify grammar for the sake of clarity, and also by the element of scale which was as yet unexamined. The subjective procedure which I adopted was quite unscientific but not undisciplined, and it produced graphs which seemed to confirm the existence of scale differences. The figures on page 3 show that the graph of Galatians is like a small scale version of the graph



of Romans. Likewise a similarity can be seen running through the graphs of Ephesians, Philippians, Colossians and 2 Thessalonians, also shown on page 3. Differences between these two sets of graphs posed a problem.

It was noted that these letters embraced an enormous range of ASL, but that the graphs had features in common. For example, they tended to begin with cycles of long and short sentences which caused a series of "steps" to appear at the beginning of the graph. An examination of these showed that the number of steps was determined by the relationship between the ASL and the total length of the work in words. When the works were arranged in order according to the number of sentences available in the opening phase, then the list of steps was found to be arranged in perfect order. It appeared possible that the typical high patterns of the Pauline graphs might be caused by a change of attitude resulting in a change of scale as the letter progressed. The opening section of each letter is on a comparatively large scale, the closing section on a small scale. It appeared likely that it was the centre section which was extended in the longer works, and that this framework might provide a possible reconciliation between the two types represented in the Romans and Ephesians groups. This concept has since been completely revised. These high patterns were quite distinct from the less contrasting patterns found for example in the Corinthian correspondence, and it seemed that the high graphs might represent material which Paul had marshalled in his mind and dictated in one operation, thus preserving a high contrast in scale. Spontaneous material seemed more likely to provide a series of smaller patterns. If this were true it might offer a way of recognising afterthoughts and intrusions into the text. These high patterns I called "prime patterns" (defined in more detail in section 4.3) for want of a better expression, as they seemed to represent primary material as against secondary material which was added in the process of dictation, or later by the same or by another hand. When the ASL's of these batches of primary material were listed in order it was found that the order coincided with Morton's groupings under different authors. This led to the suspicion that Morton's method had not succeeded in identifying material by different authors but had simply allocated the epistles to different scale bands. Morton's method of sentence division also seemed to be problematical in that the division of the Greek text at every colon, full stop and question mark appeared to damage the scale structure. Likewise methods of sampling



which took standard blocks of text of equal length, irrespective of the scale of the work or of that portion of the work, also ignored the scale structure. A study of *καί*, discriminating between its use as a conjunction, as a cumulative particle, and for emphasis, seemed to indicate that the occurrence of *καί* was more or less in proportion to the ASL when full length sentences were used (and not Morton's modified full stop sentences), but with an increase in the rate of occurrence in works with the longest ASL, reflecting the use of the word as a conjunction. Its use did not seem to have any power of discrimination between authors. A fuller consideration of modified full stop sentences is given on page 161, and a graph showing the occurrence of *καί* is given on page 167.

In short, these studies seemed to point to the existence of scale differences within the Pauline corpus, differences which the statistical approach did not take into account. The question - "May text which contains inherent scale differences be regarded as statistically homogeneous?" - not only remained unanswered; it was unasked. Problems regarding sentence division were identified but not satisfactorily solved. A consistent scale structure could be observed running right through the Pauline corpus but as almost all of these studies were limited to the corpus itself, with only a small amount of my own work providing additional test material, there was an element of circularity which could only be dealt with by covering a far wider selection of material by different authors. These studies had been carried out purely for my own satisfaction and no effort was made to publish my observations. At that point I entered the parish ministry and for the next twenty five years little time could be devoted to these matters.

In 1990 when circumstances allowed me to resume these studies I began the search for references to scale in literature and found that considerable advances had been made in the field of stylometry. Machine readable texts were becoming available and of particular interest were the grammatically tagged texts of the New Testament by Barbara and Timothy Friberg which Anthony Kenny used in his stylometric study of the New Testament. Something of an explosion had taken place in the scope of criteria employed in stylometry, most of these having a grammatical basis. Conventional vocabulary studies had a long history and now being computer aided received a new impetus. While many new criteria were being adopted, no work could be found which enquired whether these criteria were affected

to any degree by considerations of scale. Sentence length, which at one time had offered possibilities as a discriminator between authors, lost favour, as it did not appear to give reliable results in statistical studies. Yet sentence length might well be one of the most reliable indicators regarding scale changes. Sentence construction in works at the low end of the scale range is quite different from that found at the high end of the range. In text with an ASL of say eight words per sentence, the majority of sentences will be of very simple construction. When the ASL rises to fifty words per sentence then it is clear that the majority of sentences will be of compound construction. Can these two batches of material be considered to be statistically homogenous when the criteria are grammatically based? The frequency of *καί* is to a considerable extent related to sentence length and may therefore be subject to scaling effects. Positional stylometry, in which words such as *καί*, *δέ* and *γάρ* are studied as the first or second words in a sentence, may be affected to a lesser extent by scale effects, and the same may apply to tests of last words in sentences. Grammatical stylometry investigates the relationships between many different grammatical features and it seems likely that some at least of these may be affected by considerations of scale. Syntactical stylometry in which syntactical patterns are identified and compared may also be affected by scale as patterns of subject-verb-object, for example, may vary with the kind of constructions that are associated with different scale bands. This whole area is very uncertain and much work is needed to explore the effect of scale in these aspects of stylometry. That is not possible within the scope of this thesis which attempts to make a beginning in attempting to establish the existence of scale in literature. There is still little agreement concerning the validity of the criteria being used to test the variables employed in stylometry and in assessing their effectiveness in testing style. If scale exercises a significant effect with respect to any of these variables, then without consideration of scale, inferences drawn from the data may be suspect. Scale differences may confuse the criteria selected in determining authorship, with the result that variations due to scale changes may be thought to show differences in authorship. These thoughts were pursued by turning to Anthony Kenny's book, *A Stylometric Study of the New Testament* [35], which examines a large number of criteria, and to two studies based on multi-variate analysis - K.J. Neumann (*The Authenticity of the Pauline Epistles*) [50] and G.R. Ledger (*Re-Counting Plato: A Computer Analysis of Plato's Style*) [40].

Whereas Morton in 1965 had examined the occurrence of καί and δέ (in various positions) and also sentence length distribution (in tables which made comparison very difficult), Kenny gathers together data in respect of ninety six features in the epistles of the Pauline corpus and demonstrates the correlation between the various epistles in respect of these features. The process is carried through quite mechanically without allowing literary criticism to influence the result. Some tests are vocabulary based such as those which count conjunctions, particles, prepositions and the definite article. Others are grammatically based and include a study of the forms of the article and preferences of number, gender and case, the distribution of nouns and pronouns, adjectives, adverbs and verbs according to case, gender, tense and voice. The data in respect of each epistle are compared with the data in respect of the corpus as a whole. Kenny comes to the conclusion that:

What is to be said of the authorship of the epistles is in the end a matter for the Scripture scholar, not the stylometrist. But on the basis of the evidence....I see no reason to reject the hypothesis that twelve of the Pauline Epistles are the work of a single, unusually versatile author [35, p. 100].

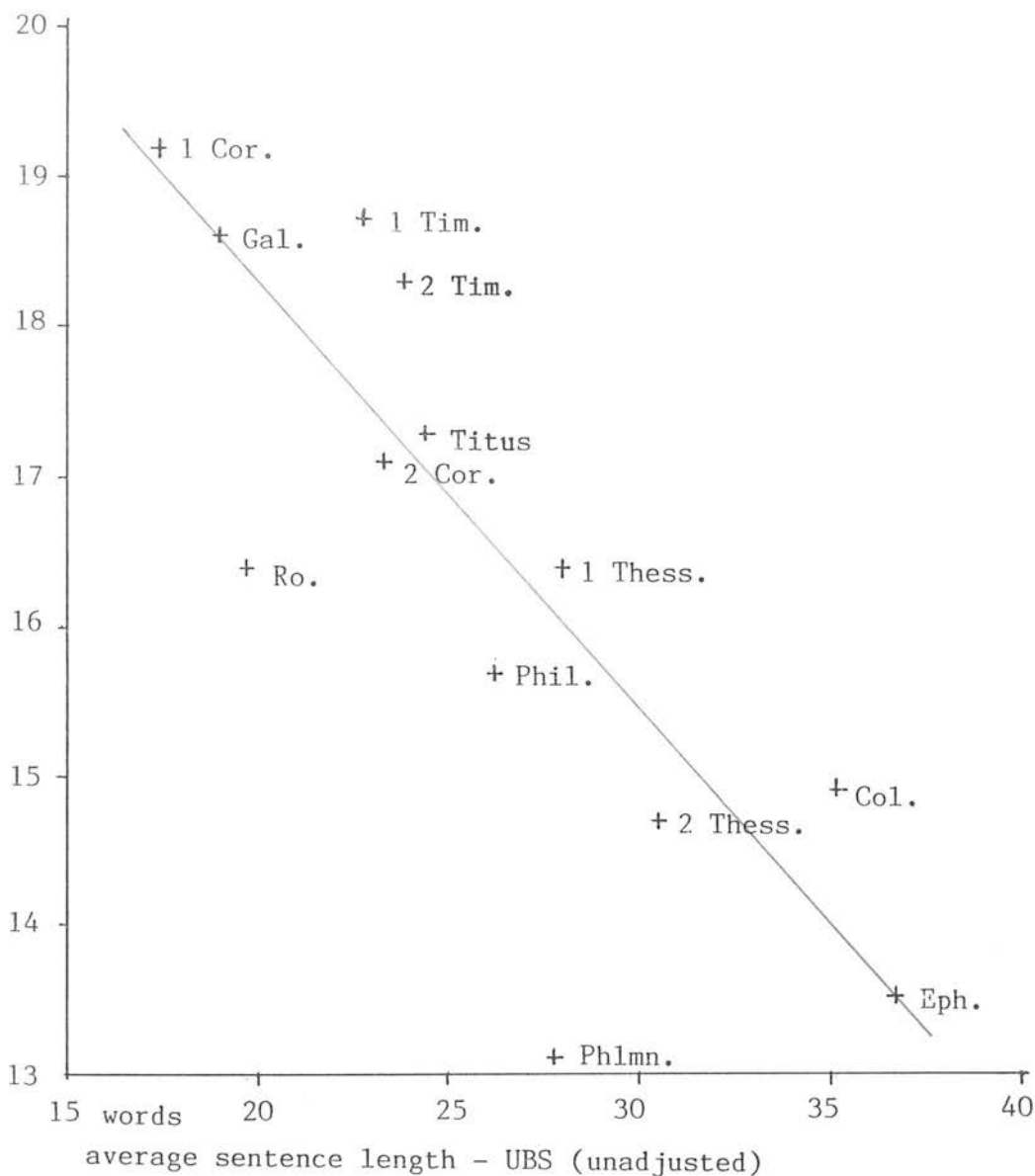
The exception is the letter to Titus and the features which set that letter apart are examined later (see page 272). It appears that if the doubtful passages concerning bishops and Cretans are removed, then much of the evidence for denying the letter to Paul is also removed. Kenny's very thorough study was made possible by the publication in 1981 of *An Analytical Greek New Testament* by Barbara and Timothy Friberg which contained the full parsing of each word in the text. Kenny finds sentence length to be of very ambiguous value in studies of this kind - a matter which will be taken up later in Chapter 3. Nowhere does Kenny recognise the existence of scale in literature.

K.J. Neumann in his book *The Authenticity of the Pauline Epistles* [50] and G.R. Ledger in *Re-Counting Plato: A Computer Analysis of Plato's Style* [40] provide massive and impressive contributions employing the most sophisticated techniques of multi-variate analysis (MVA), yet both authors are curiously diffident in presenting their conclusions. Neumann tests 617 possible indices while Ledger uses 37 variables. Neumann provides a

comprehensive overview of statistical studies which puts into perspective the confident claims regarding authenticity which previous researchers made on the basis of one or two variables. While studies employing MVA produce an enormous volume of data, they deal with the minutiae of literature. They are, in a sense, a microscopic examination. At this level they are strictly objective, but it is noticeable that when these authors consider other levels of examination in order to account for the failure of particular indices (e.g. in terms of genre), they begin to speculate on possible influences which might be responsible. These speculations remain largely unsubstantiated. It is characteristic of this approach that it is microscopic and does not attempt to make an objective assessment of the overall shape and structure of a piece of literature.

Ledger employs 37 variables of which 19 provide the percentage of words containing a particular letter (ALETs). These are applied with objectivity but without considering what precisely they may be reflecting. On the one hand they may reflect the preferred vocabulary of a particular author. On the other hand, the frequency of occurrence of a letter may be influenced by the subject matter. A paper by a zoologist on zebra will contain an atypical number of occurrences of the letter Z. Ledger makes no attempt to discriminate between these two possibilities of which only one may be related to an author's style. His BLETS and CLETs relate to the endings of words. I find that six out of the nine BLETS occur in Present Indicative endings. The frequency of word endings may very well be affected by scale, as one would not expect the occurrences of verbs with a particular ending to vary precisely pro rata with sentence length. The graph on page 9 shows that in the Pauline epistles, the frequency of occurrence of verbs generally is in inverse proportion to the ASL, though two epistles, Romans and Philemon, lie at some distance from the remainder. If the occurrence of verbs generally is thus related to sentence length, then it is possible that any consistency found in the occurrence of particular verb endings is fortuitous. Ledger's approach to chronology is also rather naive in imagining that the passing of time brings with it a growing richness in vocabulary. On the contrary, senility is apt to bring a reduction in vocabulary, and senile dementia may eliminate it altogether. Morton and Michaelson in *Things Ain't What They Used to be* [48] examine the changes in style that may occur over a lifetime in the works of Greek authors.

Frequency of verbs in the Pauline epistles (%) - from Kenny



RELATIONSHIP OF VERB FREQUENCY TO ASL IN THE PAULINE EPISTLES

A word must be said about the procedure which both Ledger and Neumann follow in putting indices to the test and eliminating those which fail to give the clearest differentiation. Both identify the authors concerned by selecting "known" works which have been confirmed as genuine by the majority view of traditional scholarship, i.e. by scholars following other disciplines. When a possible index fails to give a satisfactory differentiation in these terms it is rejected. There is danger of circularity in this procedure. If all indices are rejected which fail to give results which agree with the accepted tradition regarding known works, then those that remain will, of course, confirm the accepted tradition. It is quite possible that undetected features may be present (such as variations of scale) which cause problems both for the traditional and the statistical approaches. Both Ledger and Neumann seem to recognise this possibility, hence their diffidence in presenting their conclusions.

Neumann tests 617 indices for seven authors and eliminates those giving the poorest differentiation. When the number is reduced to the six best out of 617 the rate of successful classifications in the Paulines is only 50%. Reducing the number to five gives poorer results. At this stage these variables seem to be separating types of writing rather than authors, so the tests are redesigned and applied to Christian authors only. The 88 best indices for these are reduced ultimately to two sets of four - Varset 1 which still gives one misclassification and Varset 2 which gives correct classifications for four variables among known works of four authors, but one of these variables is suspect, not being normal. This seems to be a somewhat meagre result out of the original selections, though they may be important. The fact that four features out of 617 are consistent in the known works of four authors does not create great confidence that these indices can be reliably used to test disputed works where clearly other elements are entering into the equation or they would not be disputed. Neumann makes only a brief reference to the problems of the employment of an amanuensis by Paul and of the possibility of imitation. Neither Neumann nor Ledger makes any reference to the existence of scale in literature.

The search for references to scale in literature was then directed towards linguistics and grammar. Enquiries within the Department of English Language of the University of Edinburgh produced no pointers towards work within the area of English syntax or of any kind of formal



study of English sentences which might be related to the matter of scale. Only one remark by Norman Macleod of that department was suggestive - "Certain punctuation marks within a sentence are analogous to full stops between sentences within a paragraph". On the face of it this looked very like a scaling effect. Useful suggestions were also received from Mr. Macleod, particularly regarding the different characteristics of written and spoken language, a point of some importance as my examples included short stories by O. Henry and Barbara Erskine. While these enquiries produced little of significance regarding scale, they did point to important considerations regarding the structure of written material which was relevant to the repunctuation of texts.

In *Spoken and Written Language* [30, p. 37] by M.A.K. Halliday, the distinction is made between punctuating by clause or by tone group, that is, grammatically or phonologically. In the former case, the boundary between clauses is an analytic concept while in the latter the boundary between one tone group and another is by means of a complex system of melody and rhythm and may be signalled by a change in the contour of the melody. While contour changes refer to spoken language, the concept of tone groups seemed to tie in very well with my somewhat subjective method of repunctuating the Pauline letters in 1965. It did appear, however, that the identification of tone groups might present problems when I came to repunctuate the Greek texts in a more objective way. Halliday [30, p. 33] points to the special cataphoric or forward looking significance of the colon - an observation which supports my view that in Greek texts colons should be looked upon as links between textual units which are directly related to each other, rather than as separating pauses. Morton used colons to separate word groups.

Useful suggestions concerning the problem of punctuation were also found in *The Structure of English* [26] by C.C. Fries. Fries attempts to escape from traditional methods of grammatical study which begin with the meaning of a sentence and by parsing allocate portions of the meaning to the various parts of the sentence. He distinguishes between the structural meaning of a sentence and the lexical meanings of separate words, and studies the devices that signal structural meanings. Structural meanings are formal matters that can be described entirely in terms of form and arrangement. Form-classes (parts of speech) are determined by submitting a variety of words to a series

of test frames and those which are interchangeable from a structural point of view within a test frame are deemed to belong to the same class. His analysis produces four classes of words which cover most vocabulary but which do not correspond exactly with nouns, verbs, adjectives or adverbs. To these four classes are added fifteen small groups of function words. In addition, some attention is given to intonation which in some circumstances signals the kind of structure involved. Sentences are thus analysed in terms of structural patterns without reference to the lexical meanings of words. These studies were based on recordings of conversations, and the mark of a change of speaker was used to isolate utterance units which were considered to be free or independent linguistic units, but not necessarily to be single free units or sentences. Fries is not concerned with continuous written prose, but his section on sequence sentences is relevant to these studies as he distinguishes between sequence sentences and those which stand first in a situation utterance unit. Certain signals tie the sentence sequences to the foregoing units. Five classes of words operating as sequence symbols are examined. This approach might have some relevance to the problem of repunctuating the New Testament epistles. The present punctuation in the various versions employs traditional grammatical conventions which may well be at odds with the underlying scale structure. The placing of colons in Greek texts did not depend entirely on structural form but was largely a matter of judgement relying on the meaning of the content. Fries seems to justify a freer approach in determining word groups. Useful as these references were regarding punctuation, no significant reference to scale in literature could be found.

A whole new realm of scaling effects appeared in the late 1980's with the popularisation of the mathematics of chaos. James Gleick's *Making a New Science* [27] and Ian Stewart's *Does God Play Dice?* [58] provide histories of the development of the mathematics of chaos and of the Mandelbrot patterns with their endless repetition of motifs at different scale levels. Trials on a home computer showed that Mandelbrot fractal patterns displaying self-similarity persisted through many thousands of magnifications. The question arose as to whether there might be an element of chaos in sentence sequences which might cause patterns to appear at different scale levels. To put the matter to the test two experiments were set up. These are described in more detail in Chapter 4 and in Appendix B,



where it will be seen that it transpired that the roots of scaling in chaos, and in literature, probably lie in different areas. Nevertheless, the study helped to give particular direction to my work and must be mentioned at this point.

It was in the light, firstly, of the notable absence in statistics-based stylometry of any consideration of scale, and secondly of the fact that there appeared to be no route from past work within the area of English syntax to scale in literature, and finally of the clear difference between scale in literature and the mathematical scaling effects associated with chaos, that I chose to regard literature and the spoken word as an **art form**, and to turn to the disciplines in which the existence of scale is acknowledged. I turned to the discipline of architecture which to me was familiar ground having practised in that profession for many years, to music and art, and finally to theology where unexpected evidence regarding scale was to be found.

## 1.1 The Scale Spectrum

All creative activity takes place at its own particular point within the scale spectrum. Human creative activity takes place within a comparatively narrow band within the scale spectrum, a band which has been opened up to enquiry by the development of scientific instruments. The expanse thus perceived ranges from the wastes of intergalactic space to the interior of the atom. The largest objects made visible are superclusters of galaxies, and the smallest to be detected are subatomic particles such as quarks which cannot be observed as single entities, as like atoms, molecules and some viruses, they are smaller than the wavelength of visible light. These extremes comprise a scale range of some forty orders of magnitude, each magnitude representing a ten fold increase or decrease. Human scale is some seven orders of magnitude larger than that of the atom and the virus, that is, about ten million times larger. The scale relationship between the virus and the human is similar to the scale relationship between the human body and the largest planets of the solar system. A further increase of a similar order would embrace the planetary nebulae and another similar increase would cover the clusters of galaxies. This puts into some kind of perspective the narrow slot occupied by human activity. At the low end of the slot, the smallest artifacts may be manipulated through powerful microscopes or

manufactured at microscopic size by photographic reduction, while at the other end lie the largest structures made by Man - the Grand Coulee Dam on the Columbia River which weighs nearly twenty million tonnes, St. Peter's: Rome, pyramids, oil rigs, skyscrapers etc. Within that slot one designer may work at many levels of scale. My own design work has ranged from minute pieces of jewellery to cathedrals, comprising a scale range of some four orders of magnitude. Within this slot in the scale spectrum all creative human activity takes place in space and in time.

## 1.2 Human Perception of Scale

Dictionary definitions of scale are many and varied but those that point the way towards an understanding of scale, as I wish to develop the theme, embrace the concepts of a "ladder", a "musical ladder" and "the proportion which the representation of an object bears to the object itself: a system of representing objects in a smaller or larger size proportionately in every part" (Shorter Oxford Dictionary). The mathematical concept of a graduated table or a number of terms between two points in a progression or series is also useful. Engineers use the term "scale" in a technical way in relating objects, plans etc. to similar objects and plans which are of a different size but of corresponding proportions in their different parts. The use of the term in an architectural sense transcends altogether these mechanical relationships.

Human scale has as its starting point the human body and a person's perception of his surroundings. This is a complex relationship involving space and time. The complexity may be sensed in Heath Licklider's statement that:

in the mature conception of human scale the central premise is the fact that the size and the relationship of sizes, as the spectator experiences them are 'illusion': that there is no simple correspondence between dimension size, as it can be measured on a building, and the spectator's impression of size [42, p. 60].

The primary yardstick is a person's body as he perceives it, his height and possibly his mass, which change with the years and vary according to

his state of health. The yardstick varies with age, with growth and with experience. Individuals have an individual yardstick and individual experience. Statutory bodies cannot recognise this and regulations tend to be tailored to a six foot man and his needs. This on occasion may offend smaller people who are forced to accept designs which are not appropriate to their scale. As an architectural student I was greatly puzzled as to how Frank Lloyd Wright managed to achieve such proportions in his famous house "Falling Water". On visiting the building I found the solution: I bumped my head on the bedroom ceiling. Wright was about five foot tall and tended to design to his own scale rather than to that of the statutory six foot man.

Man also has a built-in yardstick with regard to time and the passage of time. The heart beat varies considerably with individuals and the sense of the passage of time may sometimes be related to the pulse rate. The biological clock that controls the Circadian rhythm changes subtly with the years and the perception of time changes from childhood to old age. Jet lag plays havoc with these rhythms and with the sense of time. Henri Bergson, the French philosopher, distinguished between clock time and time as we perceive it internally. What he called real time or duration is personal, not abstract; it is qualitative, not quantitative (*Time and Free Will*, 1889). Clock time is needful for practical, external purposes, but is a symbolic abstraction borrowed from spacial measurement. The two concepts of time do not always coincide and this can be seen when a speaker lays his watch on the lectern before beginning his address. This is of some importance in these studies as the shape of a spoken address or a written letter may be influenced by the speaker's or author's perception of the passage of time. As a minister I preached thousands of sermons, all of more or less equal length. I was aware of an "opening" attitude, a "middle" attitude and a "closing" attitude, and whether a sermon was fully written out or prepared in the form of headings only, there was little difference in the length in terms of time. One of the great difficulties in continuing written work from day to day is to pick up precisely the sense of scale at which the previous section was written. Not only does each individual have a different sense of scale in terms of space and time, but the sense of scale may vary with any individual according to changing circumstances.

Scale in space is directly related to scale in time. The ability of people

to estimate dimensions in space accurately varies from one individual to another and is an acquired skill. Most people are able to extrapolate from the human dimension within domestic limits: they can estimate sizes up to the size of their living room carpet with some accuracy, but cannot form an accurate estimate in the region of 250 yards. A golfer or a gunner, however, will estimate that distance with great accuracy. The transition from scale-in-space to scale-in-time is more easily accomplished than one might expect. It is too difficult to extrapolate a dimension of the order of half a mile from the standard of the six foot human frame, but people will readily translate such a distance into "ten minutes' walk". It is impossible to relate 40 miles to the human frame, but people readily grasp "an hour's run in the car". The human perception of scale in both space and time is therefore conditioned by the biological clock, by the dimensions of the human frame and by the extension of that frame by means of various tools.

### 1.3 Scale in Architecture

Scale in the architectural sense is a rich concept and the understanding of it has a long history, yet bibliography on the subject is scant. Howard Robertson's book, *The Principles of Architectural Composition* [56], was a standard textbook in use from 1924 to the early post-War years. It has a brief chapter on scale as related to human stature, and speaks of the importance of providing sufficient detail at the human scale level to allow people to relate to the scale of the whole building. The brevity of the treatment shows how little emphasis was laid on the matter of scale. Frank Orr's *Scale in Architecture* [53] has been published in U.S.A., Canada, U.K. and Australia, and is at times, imprecise in definition and extravagant in language. It is useful in showing the relationship between scale and the principles of architectural design, and has useful references concerning the ways in which buildings and environment are experienced by the senses. Heath Licklider's book, *Architectural Scale* [42], provides the most comprehensive study undertaken in recent years. It is a handbook for architects and is primarily concerned with the use of scale by architects as an everyday tool. In planning every new building, decisions have to be made regarding the scale of the building, its relationships with adjoining buildings and with the neighbourhood as a whole. One of the early problems which

every architectural student has to face is to determine how "heavy" a building should appear to be. The same accommodation may be enclosed in an envelope which may be solidly rooted in the ground, or may appear to grow out of the ground in an organic way, or may appear to be suspended lightly above the ground, poised on pilotis. The building may be designed to look very human and domestic, or imposing and monumental. These decisions involve scale used deliberately as a tool to give expression. There may be several factors involved, reflecting the properties of the materials being used in the construction, the kind of accommodation and its use, cultural influences, religious influences, aesthetic considerations and even an estimate of the social status of the client. Licklider is concerned mainly with practical design and aesthetics, and considers scale under three headings - the physical, the proportional and the human conceptions of scale.

### **1.3.1 Physical Scale**

In building, a sense of scale is established in part by the selection of materials. A building may be constructed in brickwork, the brick being the largest unit which can be conveniently manipulated by one hand. Or it may be built in stonework or blockwork, the sizes of blocks being determined by what can be conveniently lifted in two hands or by simple machine. The scale is established to a limited extent by the use of these small units. Of greater impact is the use of larger modules, structural frames, curtain wall assemblies etc. System building may have components designed to conform to a series of preferred dimensions which also help to establish the scale of the building. The way these components are handled contributes to the scale of the building, as units in a particular band of size and weight are clearly expressed while larger and smaller units are suppressed. There is in most buildings a hierarchy of building units and in general, the larger the unit the greater effect will that unit have on the scale of the building.

Language also employs a hierarchy of units, building bricks of language - phonemes, morphemes, words, phrases, clauses, sentences, complex constructions using colons and semicolons, paragraphs, chapters, volumes. These may contribute to the physical scale of the text just as building components of various sizes do. A long work of literature may be conceived



entirely on a domestic scale with short, simple sentences and no discernable scaling structure, while a short piece may have a wider distribution of sentence lengths and a strong scaling structure, and may be quite monumental in character despite its brevity.

The architect must arrive at a synthesis of the sizes of the building units he employs. This may find its expression in a standard bay unit divided into sub-units. Such a system may be found in a variety of buildings ranging from a mediaeval hall to a modern office block. The style may be expressed through these physical elements of construction or they may be buried entirely beneath a veneer of decoration. In architecture the structure is perceived visually: in literature it is not so clearly visible though signs may be detected and the scale may be expressed through the medium of graphical analysis.

### **1.3.2 Proportional Scale**

In any creative design where there is a repetition of motifs there is the urge to bring these units under the discipline of some controlling system. In architecture, the designer may look for an order of division providing relationships which satisfy the eye. In the written word, in poetry or in prose, rhythms may be highly structured or may achieve a loose balance. One might consider the preferred dimensions of system building to be a kind of visual scansion providing a framework for the design. Style arises through the choice of repeated motifs and the manner in which they are used. Different architects, authors, poets and musicians have their own preferred ways of selecting or combining different motifs or basic building units. Motifs may be used at different scale levels and Licklider holds that "the different proportional systems....may be regarded as a more or less successful search for the system that will yield the greatest number of similar shapes, similarly related" [42, p. 35]. The eye and ear recognise, either consciously or subconsciously, the repetition of motifs at different scale levels, and where these patterns are thoroughly integrated the design has a quality of inevitability. In the visual arts the repetition of motifs at different scale levels may be visually perceived and analysed, but it has not hitherto been appreciated that an author may produce written works at different scale

levels with similar internal arrangements. Unexpected comment on the repetition of motifs at different scale levels comes from the mathematicians studying chaos. Mandelbrot [27, pp. 116f.] considered the architecture of the Bauhaus and the art of Josef Albers to be "spare, orderly, linear, reductionist, geometrical". Like the architecture of Mies van der Rohe he found them too simple. Their simple shapes were describable with just a few numbers. They do not "resonate" with the way Nature organises itself. A simple geometrical building may have scale, but only one scale. The feeling for beauty comes from the combination of elements of different scales with varying degrees of order and disorder. It appears that something in the nature of chaos with its windows of order is echoed in our appreciation of beauty. It requires the combination of motifs of different orders of scale to give aesthetic satisfaction. The repetition of motifs at different scale levels allows recognition to occur, consciously or unconsciously, giving satisfaction to the observer.

The most elementary proportional systems use simple fractions. Some sizes are acceptable while others are rejected because they cannot be easily divided into the main controlling dimensions. A more complex system, like Le Corbusier's Modulor [38] provides a geometrical progression of Golden Section ratios. Such a system allows a great variety of shapes to be provided from a small number of dimensions yet the shapes are all linked together with complete integrity. The kind of relationship that produces similar shapes at different sizes has been found to be inherently beautiful. Architects produce such relationships: so do musicians. In literature we sense the underlying structure but it is largely invisible and has to be demonstrated graphically.

Such proportional systems in architecture, however, make good servants but bad masters. Applied unimaginatively, they can kill creative design and produce metres of technique with no soul such as may be seen in endless acres of curtain walling or in extensive housing units which have no overall shape or character. Le Corbusier was always prepared to violate his own system if it interfered with free imaginative conception. He considered his system to be what Licklider calls "an armature to help the imagination to conceive of, and to order, the most complete set of relationships that architects have ever attempted to synthesise" [42, p. 59]. This refusal to be bound entirely by the dimensions of a system is important, for as we will

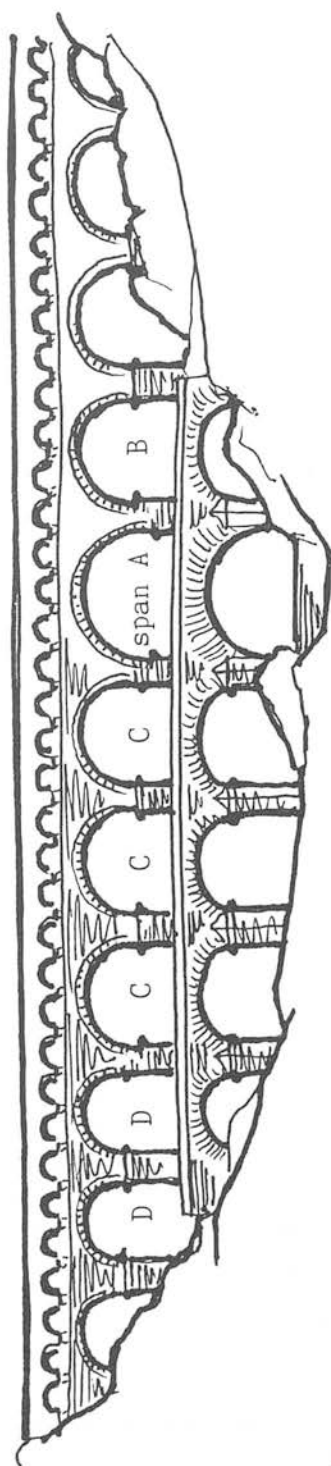
discover, human perception of the system may not be identical with the system itself. Indeed the subtle deviations from the underlying structural system can provide much interest. The Roman aqueduct, the Pont du Gard at Nimes, shown in the sketch on page 21 has intriguing variations from the basic system which are arresting and interesting. The spans of the lowest arcade were determined by the foundations available, the largest span crossing the river. The next arcade provides arches which all rise to the same height but with four different spans and springing heights. The top tier carrying the watercourse has an arcade of small arches the spans of which bear no direct relationship to those of the lower arcades, yet the whole design holds together as the mind accommodates these subtle variations. It is important to realise that in literature, as in music, the underlying structure may be strong, yet not rigid, an armature on which to build, yet allowing the human mind to achieve a balance intuitively.

### **1.3.3 Human Scale**

The design problems in architecture are rather different from those in literature in that architecture is a visual art and scale is visually perceived. In present times a building has to be conceived in the mind's eye down to the last detail before it is built. The days are past when one could build a building by eye and pull it down and rebuild until it gave satisfaction. Part of the fascination of the art is to see how closely the original conception is matched in the finished work. A design when actually built always varies in some degree from its conception in the architect's mind. Apartments may appear to be bigger or smaller than anticipated; textures may be stronger or weaker; colours may be more or less powerful in their effect. To control scale an architect must have a highly developed sense of dimension and the ability to estimate dimension accurately. The gulf between the concept of the building and the execution of the design reminds us that scale in architecture is not derived from a mechanical application of rules but has a human dimension.

It was noted above in the section on the human perception of scale (page 14), that Licklider [42, p. 60] pointed to the "illusion" in the human appreciation of dimension. There is a difference between physical





PONT DU GARD, NIMES

dimensions and the spectator's impression of size. Size is a relative and not an absolute quality. It is related to the human frame, as an architect knows who has designed schools for toddlers. A toddler's experience of a table is normally to look upwards to see the underside of it. In designing tables for a nursery school the designer is giving the infant the equivalent of an adult experience of a table in which the height of the table lies approximately between knee and hip. There are certain building units which are related directly to the human body and as human stature changes, so do these units. The tiny treads and risers in the steps within the walls of the broch on Tiree indicates how small in stature were the inhabitants of these structures a thousand years ago. Today treads and risers are related to the stature of modern folk. There may be some accommodation between the size of the tread and the size of the riser but generally the product of the two sizes will give a figure of around 63-66 inches. They may be 12" x 5.5" or 9" x 7". The basic dimensions are common to all staircases yet different staircases have quite different scales. This cannot be achieved to any extent by altering the sizes of the treads and risers but the steps may be made wider. At Sydney Opera House the approaching steps are the entire width of the building, forming a monumental approach which is far wider than the traffic flow justifies. Handrails cannot vary significantly in height but scale is achieved by making handrails heavier and balusters thicker. The basic dimensions of these components are related to the human frame but their handling can produce an impression of domesticity or of monumentality, of small or large scale.

Stairs, handrail heights, counters, door sizes, door handle heights, chair heights have dimensions which are determined by the human figure yet within these constraints there is room for much variation in scale. Sofas in a lounge, fat and comfy, are conceived on a different scale from dining room chairs, elegant and spindly. Doors vary from narrow railway carriage and caravan doors to magnificent church and public building doors. Features are "in scale" when they appear to be the size which the observer expects them to look. They are in scale when the human figure seen against that background, appears to be the size it is expected to appear. But human expectations can vary greatly and there are subtle variations in expectation between regions and in different cities. Licklider points out that in Rome a visitor may be surprised by the apparent smallness of people and furniture in

his hotel room and by the apparent largeness of the room's dimensions. On the streets he is impressed with the largeness of the buildings. In Venice, a town of small alleys and little arches, people and furniture seem larger. In England, a Cotswold village seems to have toytown characteristics. On going to London from Glasgow, I still find famous London streets to be smaller than expected. Indeed the relative scales of Glasgow and London may be measured simply by taking the average size between the centres of windows in city streets. English people apparently "think smaller" than Scots.

St. Peter's, Rome is designed to overawe, to create in the observer a feeling of smallness. It is monumental. This points to the accommodation that must be made between the physical sizes which relate to the human frame and the dimensions which are chosen to create such feelings of smallness, or indeed of bigness. It is the accommodation between man's physical size and his perception of himself; one might say between his physical and his mythological understanding of himself. The huge doors of a public building suggest that there are very important people at work there, people of superhuman stature. The door might be twenty feet high, three times the height of a normal house door, but the door handle must still be at the three or four foot level. If the handle were at half the height of the door, as it might be in a dwelling house, then no one would be able to reach it. Churches tend to be larger than life in scale, reflecting the perception that the function they serve is larger than ordinary life. The managing director of a business sits at a much larger desk than his typist who may do much more work: the big desk reflects the myth of the man of stature - but he does not realise that in fact the big desk may make him look small. Changes in scale occur as human perception changes. In the Pauline letters, a change in scale accompanies the change from the theological to the ethical, which may be compared with the change in scale from church to manse.

## **1.4 Monumentality - a non-rational component**

The scale differences between designing for infants in a nursery school and designing for adults are based on physiological considerations and are dealt with in a rational way. Dimensions are based on the human frame at

different stages of development. In designing for community functions further dimensions are also dealt with rationally. A community hall may be used for badminton and may require an appropriate ceiling height; a hall used for concerts may need to have certain acoustical qualities. Where large numbers of people gather together, practical considerations of ventilation and traffic movement may require an increase in scale. These are dealt with in a rational way. But the element of monumentality introduces a design component which is non-rational. The domestic ceiling height based on the statutory six foot man is seven foot six inches. Where many people congregate a rather higher ceiling is required, but what rational justification can be found for the ceiling height of nearly 160 feet in Beauvais Cathedral - a height which is three and a half times the span of the building? It is true that the acoustic qualities of cathedrals with a reverberation period of up to twenty seconds can give a magnificent sound, but at the expense of intelligibility whether the sound is spoken or sung. In buildings like cathedrals, baronial mansions, tombs, palaces and certain public buildings in which there is an element of monumentality, it is not the physical stature of six foot man which is being expressed but a mythological understanding which people have of themselves, or of others, as bishop, business tycoon, dictator, war hero, ruler of royal blood or politician. Indeed, ceiling heights only occasionally reflect the physical needs of six foot man. More often they reflect a valuation of the worth of different classes of people - middle class tenements in Glasgow at 10 to 12 feet; baronial mansions at 12 to 20 feet; Boat People's cages in Hong Kong at 3 to 4 feet; African slave boats' 'tween decks of 20 inches. Alternatively, the element of monumentality may express something which is sublime in terms of art, or may express something which is greater than man, something wholly other.

The dimensions of monumental buildings are just as precise as those which are designed to meet the physiological needs of people but there is a non-rational element in determining these dimensions. The height of the figures in the Commando Memorial at Spean Bridge is approximately eight feet, and the figures stand on a plinth so that the eye level of the viewer is in line with the feet of the statues. The figures are rather larger than life, expressing the respect which people have for men who took such risks. In fact the stature of commandos was little different from the average: great height was not necessarily an advantage in commando operations. The

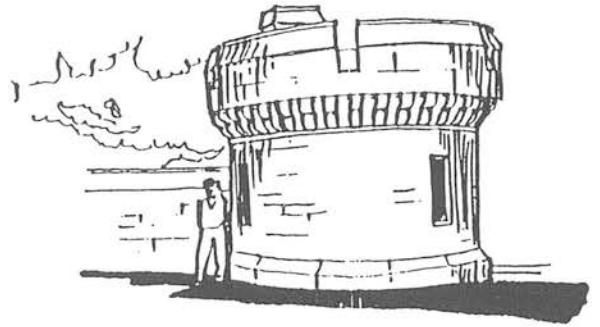
placing of the figures at above eye level also contributes to the feeling of awe. Heroes are customarily looked upon in this way. At Blair Castle several very large suits of armour may be seen which perpetuate in the minds of visitors the myth of the mighty men of Atholl, but a few fragments of chain mail on display reveal that in stature these mighty men were child size by today's standards. Why should memorials show heroes at greater than life size? What determines the height of eight feet for the Commando Memorial? The towns of the former U.S.S.R. abound with twenty foot high statues of Lenin which also express the popular estimate of his stature as a leader. The decision as to whether a statue should be eight feet high or twenty feet high may be partly an economic one, but not entirely. The figures on Easter Island are up to thirty feet high and were erected by a people living at subsistence level (page 26). These dimensions, which are just as real as those arrived at by rational processes, reflect a mythological understanding and constitute an irrational component. Wherever monumentality is concerned, motif becomes much more important than size which contains an element of arbitrariness, and scale becomes more important than dimension.

It may be noted that vocabulary often indicates scale rather than size. Big refers to size: grand and grandeur refer to scale. Huge refers to size: majestic refers rather to scale. Immense refers to size: monstrous may have mythological overtones and refer to scale. This latter thought will be developed later with reference to theology and myth. Monumentality is not limited to architecture. It is found in other arts, in sculpture, in painting, in poetry and in prose.

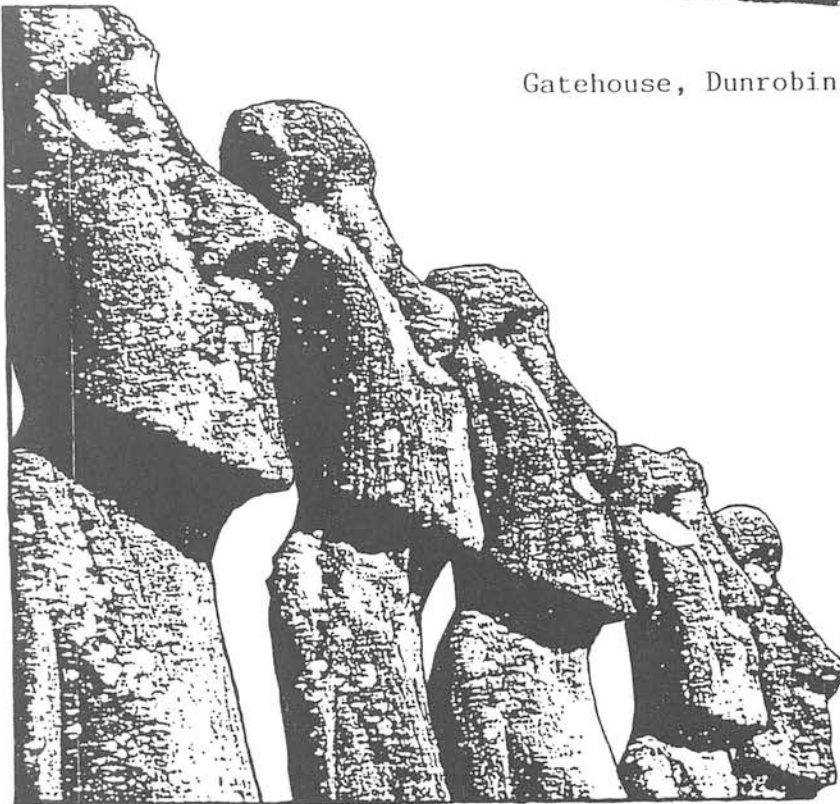
It may also be noted that it is possible for elements of different scales to be found in one building. The sketches on page 26 show gatehouses to Dunrobin Castle and Lude House, Blair Atholl. These are small domestic buildings with very modest accommodation, and the doors and windows are detailed accordingly. The parapets round the roof, however, are borrowed from the castle and the mansion house, and are on an altogether larger scale to indicate the importance of the establishments which these gatehouses serve. It is quite common to have such contrasting scales in juxtaposition, each expressing a rational or an irrational aspect of the design. In the Pauline epistles a similar contrast of scale occurs between the theological and the ethical sections of these letters. Taken as a corpus, the writings of



Gatehouse, Blair Atholl



Gatehouse, Dunrobin Castle



Monoliths, Easter Island



Isocrates cover an enormous scale range. The earlier writings which in later life he disowned as being unworthy have an ASL of between 25 and 30 words while his last monumental work, *Panathenaicus*, published at the age of 94, has the extraordinary ASL of approximately 54 words per sentence.

## 1.5 Scale in Music

Our concern in music is not with musical scales which is usually the only reference given by dictionaries of music, but rather with the repetition of motifs of similar form but with different dimensions, that is, at different scale levels. One may readily appreciate the difference between a child's nursery rhyme and grand opera, or the difference between the *Toy Soldiers' March* and Wagner at his grandest. One may also readily appreciate the difference between an amateur tenor singer in a church choir, and Pavarotti filling the Opera House with a magnificent volume of sound. These scaling differences are reflected in physical dimensions and in the dimension of time.

Marches at a tempo of 100-120 crotchet beats per minute are geared to the physiological characteristics of marching soldiers, and a quick march may correspond roughly with the increased pulse rate. A slow march deliberately reduces the pace to a point well below the normal pulse rate, which creates in the observer a feeling of awe. This feature is exploited in Edgar Barratt's "*Coronach*", a Highland lament in which the rhythm is reduced to fifty beats per minute - the failing pulse of the departing. It reflects the myth of the departed as the scale is extended beyond that of the normal biological clock. Conductors, who have their own personal biological clocks and who may lead their orchestras with metronomic precision, vary in their interpretation of a piece of music as the standard of clock time given by the metronome is adjusted by means of subtle variations in scale.

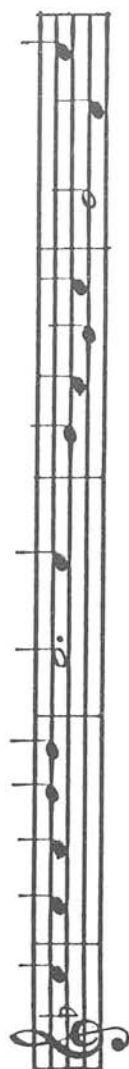
Melody, rhythm and harmony which are the basic constituents of music need to be given a sense of form in order to create a satisfying whole. Recognition plays an important part in this and a simple way of achieving such a unity is through the statement, contrast and repetition of easily recognisable musical ideas. Formal patterns may be built up on a small scale using the phrases of a tune and may also be constructed on a large scale using the individual sections of a movement. Augmentation in music is well

documented. It is the repetition of a subject, especially in fugues, in notes double or quadruple those of the original statement. A fairly straightforward scale progression is found in Brahms' variations on the theme by Joseph Haydn, opus 56b. The first quiet statement of the theme is in 2/4 time, the tempo *andante*. Subsequent variations progress through 2/4 with varying degrees of ornamentation, 3/8, 6/8 and 3/4 time, building up in complexity and with subtle variations in scale between the movements. The finale is in 4/4 time, the tempo again *andante*, and builds up to a climax, ending with *ritard.*, *molto ritard.* and final crashing chords, double *forte*. In terms of real time, the beat in the finale is identical with that in the initial statement of the theme at the beginning of the work, and the metronome confirms that this is so. But the finale gives the impression of being on a grander scale. This is due partly to the change from 2/4 to 4/4 time which in itself produces an illusion of space. This is accentuated by the runs of eight semiquavers, the busyness of which creates a perspective which is also filled out with a wider orchestration. This is the musical equivalent of the "illusion" to which Licklider refers in relation to architecture (page 20). In this case the impression of increased scale is the result of a change in texture, but as perceived by the ear is a real and recognisable change of scale. Scale may therefore on occasion be measurable in real dimensions in space or time. On the other hand it may be an illusion brought about by the comparison of textures, but nevertheless real and recognisable by the observer.

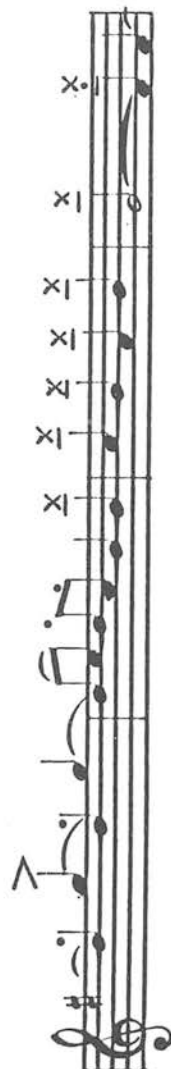
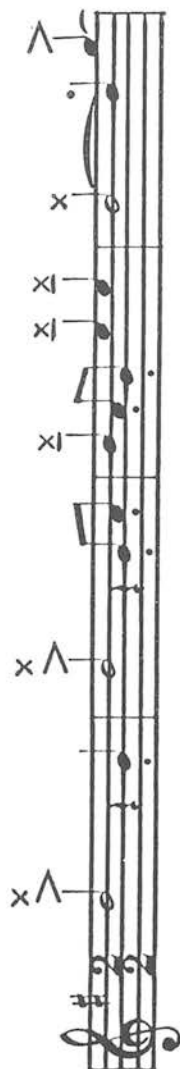
A more loosely structured scale difference may be seen in Karg Elert's improvisation on the tune 'Nun Danket'. On page 29 the first four bars of the theme are given, derived substantially from Mendelssohn's arrangement in his *Lobgesang*. The original is from Crüger's *Praxis Pietatis Melica*, Berlin, 1648, where it is set to 'Nun danket alle Gott'. In Karg Elert's improvisation, also shown, this portion of the theme occupies eight bars, compared with four, but it should be noted that it is not a simple enlargement of the original. It is grander in conception. Some of the notes of the original are extended while others are of the same length. The subject is handled with freedom, and while the notes of the original are recognisable, they are transformed into a new work on a different scale.

It is quite possible to perform a work at a variety of scale levels without altering the score. This was done experimentally with the hymn





NUN DANKET - from Mendelssohn's arrangement in *Lobgesang*.



NUN DANKET ALLE GOTT - from the chorale improvisation by Sigfrid Karg-Elert Op. 65.

'Lord of all being' set to the tune Ombersley. A member of my church choir was asked to hum the tune and her performance was surreptitiously timed at 18 seconds. The choir was asked to sing the first verse unaccompanied which was timed at 24 seconds. After some work on the text and on musical expression the choir sang the whole hymn, the last grand verse being timed at 35 seconds. At no point was the music dragged: it was enlarged in scale with each rendering. The enlargement was not mechanical with each element being enlarged proportionately. That is indeed not possible as the explosive consonants are not capable of extension. Other consonants may be sustained indefinitely. When sung with expression, certain vowels are sustained and crescendos and diminuendos are carefully controlled to create an impression of 'grandeur' - a word which is indicative of scale.

In the Scottish Psalter, the words of the psalms are forced into the straitjacket provided by the metre of the tunes. In marked contrast, African hymnody is distinguished by the way in which tunes are made subservient to the words. The rhythm is often freely adjusted to accommodate the words. It is often virtually impossible to force African melodies into a European time signature. Rather than attempt to give musical illustrations here, the following quotations from the prefaces of books of African hymns will serve to make the point. In the preface to *Free to Serve: Hymns from Africa* [25] Peter McLean says "it is impossible for the printed melodies to present more than the **barest skeleton!** (his bold type). It is for those who use them to build and shape them and give them life." H.M. Taylor, in the foreword to *Tunes from Nyasaland* [59] writes, "I have ventured to fill out the harmonies of these more modern African tunes: but the clashing fourths and fifths of the tunes in Part 1 (old African melodies), and the swelling and falling of the interweaving melodies, would be spoiled by any attempt at conventional harmonising." Tom Colvin, in the preface to *Leap My Soul* [39] writes:

These are not simply a new body of hymns: they imply a new style of singing and even a different approach to worship. The sharing of a hymn between leader and worshippers, or the passing of the melody back and forth between two groups of singers, introduces an element of drama and a greater excitement into the church's praise. The repetitive character of the melodies and the habit these hymns have of expanding to a climax can elicit a more spontaneous response and a fuller participation among the worshippers. The customary overlap between

verses, and between leader and people, contributes to this cumulative effect. Common in the African Church are also the spontaneous improvisation of harmonies (say, in thirds or fifths, with treble and bass voices often richly doubling at the octave) and the use of percussion instruments for accompaniment (organ or piano would be quite inappropriate). Detailed instructions about performances are not as a rule given in the body of this book, and users are encouraged to interpret the hymns in their own way, in the overlap of voices, the addition of harmonies, and the use of percussion and rhythms...Although the bulk of the melodies are written in modes which sound similar to the scales used in the West, nevertheless they are not necessarily identical; key signatures are not therefore given, unless they are necessary to avoid a plethora of accidentals in the notation of the melody.

This points to a highly disciplined freedom. A comparison might be made with the singing of the metrical psalms in the tradition of the Free Presbyterian Church in the Highlands and Islands of Scotland, in which the singing is led by a precentor, but the time is a matter of individual choice governed by mutual consent, with much overlapping of individual voices.

Time signatures and tempo may be compared with the modular units used in architectural design. Like the rhythms of poetry they provide a framework on which the design is based and make their own contribution to the scale of the work as bricks and building blocks do, but it is the larger units which have greater influence in establishing scale. *Leitmotifs* provide an example of musical themes which are associated throughout the work with a particular person or situation. These are not reproduced simpliciter, but show scale variations appropriate to the circumstances. Prose may lack the formal basic structure which underlies much music and poetry, but subtle rhythms are found together with repetitions of patterns at different scale levels. These will be explored in later sections.

## 1.6 Scale in Theology

The non-rational component which is found in monumentality may be linked with the non-rational feelings of religious experience which are explored by Rudolf Otto in his book, *The Idea of the Holy* [54]. Otto examines the feeling of the uncanny, the sense of awe in the presence of something or Someone great and holy and powerful, the sense of creatureliness, of impotence and dependence in the face of the mysterious unknown. The language Otto uses is full of contrast - the creaturely as against the almighty; the small and powerless as against the great and powerful; nothingness and impotence as against majesty or overpoweringness. There is a contrast of size, of scale, of level of being.

Otto identifies the Greek adjective δεινός with the numinous and finds the nearest German equivalent in the word *ungeheuer* meaning monstrous, but not simply huge in quantity or quality. He illustrates the use of the word drawing from Goethe who used *ungeheuer* to denote "huge in size - what is too vast for our faculty of space-perception, such as the immeasurable vault of the night sky". He continues, "In other passages the word retains its original non-rational colour more markedly; it comes to mean the uncanny, the fearful, the dauntingly 'other' and incomprehensible..." [54, p. 54f]. The word begins by being an expression of size and becomes an expression of scale. The link between massive scale and numinous quality is expressed visually in primitive structures which were foci for the numinous - standing stones, huge monoliths arranged in stonehenges, mastabas, obelisks and pyramids. These are massive structures beyond the capacity of any individual person to build and it therefore requires community effort to construct them. Their prime characteristic is massiveness, superhuman scale, thus setting the feeling of what Otto calls "the sublime" which is the aesthetic equivalent of the numinous.

In music Otto finds the ultimate expression of the numinous in Bach's Mass in B Minor, especially in the mystical Incarnatus in the Credo. The weird cadences sinking away in minor thirds, die away *pianissimo* leaving utter silence. For Otto that is the most numinous moment in the Mass. It is interesting to note that the Credo begins with a pulse rate of about 100 beats per minute but the Incarnatus drops to about 42 beats per minute

indicating a massive change of scale. One might compare Barrett's *Coronach* (page 27). In this context, silence is massive. The empty void expresses the most massive scale. Otto points to this in connection with Chinese art in the classical period of the T'ang and Sung dynasties:

The spectator who, as it were, immerses himself in them feels behind these waters and clouds and mountains the mysterious breath of the primeval Tao, the pulse of innermost being. They contain the knowledge of the 'nothingness' and the 'void', of the 'Tao' of heaven and earth, which is also the Tao of the human heart [54, p. 82].

Scale can be expressed negatively in darkness, silence, emptiness and empty distances. It is remarkable how classical Chinese buildings make use of the space between buildings, rather than the buildings themselves, to convey an effect of massive scale. These buildings are not only related to the internal spaces, but also to external space and the empty distances of the surrounding landscape. A similar expression is seen in Ansel Adams' photograph entitled "*Moonrise*" (pages 35f.). The numinous experience of the wide emptiness of the desert has been sought by many great thinkers - Moses, Jesus, Paul. The emptiness is an expression of scale.

Scale is affected by "numinous content". Otto finds a "numinous atmosphere" permeating the writings of St. Paul and points to Paul's dualistic depreciation of the flesh and the sense of creatureliness. He cites Romans Chapter 1 - a chapter in which Morton finds statistical anomalies. Romans begins with a regular cycle of groups of long sentences alternating with short sentences and it is notable that the groups of long sentences are all concerned with creatureliness. The first is concerned with guilt; the second with judgement; the third - "There is none righteous"; the fourth - "All have sinned...". It appears that the numinous quality which Otto detects and associates with creatureliness is reflected in an increase of scale which in turn is reflected in sentence length. The feeling for the numinous and the sublime is, however, non-rational, and therefore the scale factor is not predictable. Nor does it show statistical consistency. This does not mean that it can never be quantified, but depending on the behaviour of other factors, scale in literature may be reflected in sentence length.

## 1.7 Scale in Art

Otto finds in "the sublime" a kind of aesthetic equivalent of the numinous. Like the numinous, the sublime:

is daunting, yet again singularly attracting, in its impress upon the mind. It humbles and at the same time exalts us, circumscribes and extends us beyond ourselves, on the one hand releasing in us a feeling analogous to fear, and on the other rejoicing us [54, p. 57].

An object with the quality of the sublime:

must approach, or threaten to overpass, the bounds of our understanding by some 'dynamic' or 'mathematic' greatness, by potent manifestations of force or magnitude in **spacial extent**. But these are obviously only conditions of, not the essence of, the impression of sublimity. A thing does not become sublime merely by being great [54, pp. 56f.].

The non-rational component which we found in monumentality and in the numinous is also encountered in art.

Jung distinguishes between the psychological mode of artistic creation and the visionary mode [33, pp. 179ff.]. The former draws from the realm of human consciousness and deals with life as it is experienced, reflecting and interpreting every facet of life with an artist's eye and touch. The latter draws from the subconscious. At this point Jung's language, like Otto's, reflects scale, in terms like "monstrous", "timeless depths", and "a vision of other worlds". In locating the origin of this aspect of the creative urge in the subconscious, with access to hidden worlds, Jung forms a link between the "numinous" of theology and the "sublime" of art.

In considering scale in art we are not concerned with the sizes of different works of art. These may range from tiny miniatures to megalomaniac oddities like the Mount Rushmore sculptures or those on Stone Mountain near Atlanta, Georgia, which involved the removal of millions of tons of stone. There is little to commend these monstrous works other than sheer size. Rather we are concerned with works which show



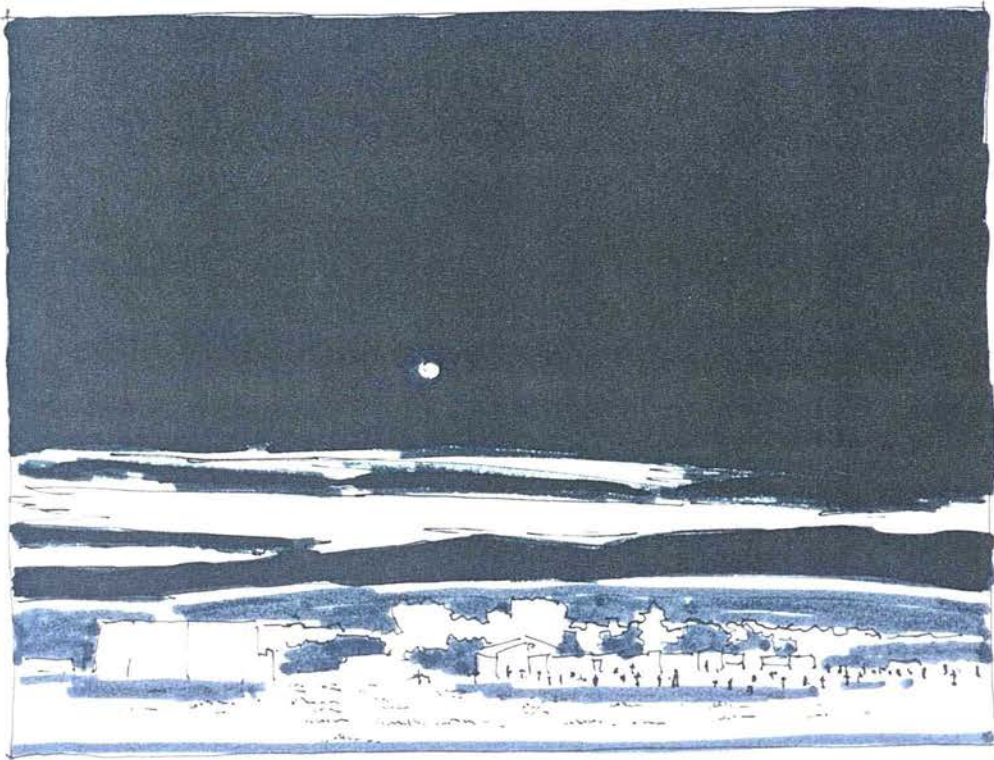
some insight into the nature of scale and we would take two examples.

In 1529 Altdorfer painted a remarkable canvas, "The Battle of Alexander on the Issus River", a picture which portrays the world as from an immense distance and sees the momentous events of human history in the perspective provided by the scale of the Universe. It represents the crumbling of an empire as the armies of Alexander and Darius engage in battle. The massed armies are represented in microscopic detail, pushing the techniques of oil painting to the limit. The minute scale of the soldiery is in contrast with the vast scale of the setting - a panorama of endless mountain ranges, and a storm of cataclysmic proportions.

The photographic work of Ansel Adams displays a penetrating sense of scale. On page 36 a sketch is shown of "Moonrise", a black and white photograph of Hernandez, New Mexico by moonlight. Two thirds of the photograph are occupied by an empty night sky with a tiny moon above a line of low hills. In the foreground lies the small village. There is a progression of scales from the texture of the crops at the bottom of the picture through the modest buildings of the village, thence to the mountains and the low night clouds and above all the huge empty sky. There is a deeper level of meaning. A close examination reveals the crosses and monuments of the village graveyard, symbolising the finitude of human life which is contrasted with the infinite reaches of space. It speaks of the temporal and the eternal, of the insignificance of man against the infinite background of eternity. These two examples represent panoramic views of scale.

Mitchell Feigenbaum is quoted by Gleick [27, p. 186] as saying "The only things that can ever be universal, in a sense, are scaling things." Cubism, which has probably been the only twentieth century art movement of lasting influence, may be said to have begun when Cezanne remarked that everything in Nature could be reduced to three shapes: the cylinder, the sphere, the cone. Picasso and Braque explored this prior to the First World War. While Cubism represented the movement of the times away from both Realism and Impressionism and sought to distil the truth, too high a degree of abstraction reduces the scale perspective and results in a vitiation of the truth. Art that satisfies contains elements of all sizes held within scale relationships. The detail of Monet's lily ponds or of Turner's storms displays





Sketch of "Moonrise" by Ansel Adams

enormous depths of texture which may be appreciated at many scale levels. In this they are true to nature where beauty is found not only in pure crystalline forms but also in the leafless tree with its endless repetition of motifs scaled to different dimensions.

## 1.8 Scale in Literature

The non-rational element which is found in monumentality, in the sublime (as defined by Otto) and in the numinous, may be found in literature, transcending the restraints of formal structure. It is unpredictable in dimension and in proportion, yet may on occasion be measurable with precision. Motif may become more important than dimension in identifying the effects of scale.

Poetry has an underlying rhythmic structure which is akin to the modular grid of architectural design. It provides a structural frame on which to build but also imposes certain restraints. The grid itself provides a scaling reference as do the building units in architecture. Rhythm and scansion provide certain restraints but do go some way towards establishing a scale level. There is danger in allowing scansion to exercise total control, just as in architecture the expression of a modular grid may lead to dull monotony. In general, the scale factor is allowed to develop through the use of more extended motifs which transcend the basic rhythm. In music the time signature performs a similar function in establishing the scale of the framework and the basic rhythm, but scale is allowed to develop through musical motifs which transcend that basic framework. Scale comes into play as these extended motifs allow the free expression of the non-rational component. Various steps to escape from the rigidity of such frameworks may be noted.

In the section on Scale in Music (pp. 30f.) it was noted that African hymnody refuses to be contained within a rigid metric structure, but allows feeling for the natural rhythm of the words to take precedence. In poetry, the abandonment of rhyme offers a first step in escape from these restraints, the abandonment of scansion a further step. Liberated from these structures the poet may express himself freely, using words as an expressionist painter might use strokes of the brush, with a highly disciplined freedom, but

unfettered by a rigid structure. The larger motifs through which scale is achieved are then freely available.

Prose writing would be tedious indeed if all sentences were of identical length. The writer is free in that respect but does have to cope with the limitations of conventions of grammar, should he choose to observe them. These provide a basic structure, but simple grammatical constructions have their limits. A simple sentence consisting of subject, verb, object is limited in scope and in length. Compound sentences allow greater variety but still within a discipline. The use of colons and semicolons allows virtually unlimited expansion and unlimited development of the scale factor. Once a writer has embarked on these extended constructions or has shaken off the formal structural restraints, the scale factor may be developed in an uninhibited way. James Joyce's *Ulysses* [34] contains a sample of a hundred sentences with an ASL of 5.65 words, a sentence using colons which extends to over 600 words, and an unpunctuated passage of over 40,000 words. When an author breaks through these constructional restraints in this manner, the scale may explode to any degree and ASL is no guide at all to authorship. The example of Joyce may be unique, but each author may in his writing comprise a scale range the width of which is roughly indicated by the average sentence lengths of his various works.

It is not uncommon for an author to include material at different scale levels within one work and when this occurs it must be recognised that material falling into different categories is being combined. In the monumental door (see pp. 22f.) dimensions relating to the human frame (e.g. the height of the door handle) were combined with dimensions related to a mythological understanding of man (e.g. the door height of twenty feet). The first of these dimensions was arrived at by a rational process: the second is irrational and quite unpredictable. The two dimensions fall into quite different categories. It may well be that literary material of different scales may fall into quite different categories and it is still unclear whether such differences affect the statistical homogeneity of such mixed material.

Changes of scale may be related to the audience being addressed. There is some reason to think that the difference in scale between James S. Stewart's lectures and his sermons is due to his different ways of addressing students and congregation. Differences in scale in Paul's writings may

depend upon whether the material had its origin in arguments against his Jewish opponents or was addressed to troubled Christian converts. A politician may be able to write terse memos, but if he does not wish to give an interviewer the opportunity to ask a question, may produce endless sentences.

Scale changes may also be related to fluency. Young children write on a scale which is different from that of more mature people who have learned to use many kinds of conjunctival devices. Scale may change with increasing fluency. A person struggling to express himself on a new subject and with vocabulary which is unfamiliar to him may have difficulty in constructing substantial sentences. When he becomes fluent in the subject, however, he may freely use long and complex sentences. This raises the possibility that the brain's memory bank may store material with varying degrees of fluency and at different scales levels. One of the problems in analysing the Gospels is that so much material may have been frozen by oral tradition at a particular scale level. Combining remembered material with spontaneous writing presents a similar problem. For example in preparing a sermon with difficult content in which the preacher may not have developed much fluency, he may wish to introduce as an illustration a story which he has told many times before. The story is told exactly as he has always told it, at the scale level at which it is established in his memory and which is quite different from that of the rest of his sermon material. This results in a sermon with uneven textures.

Scale is concerned with the texture of the material rather than with the overall size. This must be made quite clear as the term scale is frequently used wrongly. Scale is not concerned with the overall size of a work. If a cathedral nave consisting of ten bays is burned down so that only one bay remains, the scale of that bay is unaltered: the texture of its constituent parts remains the same. If a terrace of small houses, built on a domestic scale, is extended until it is a mile long, it remains on a domestic scale because the texture of its constituent parts, doors, windows etc. remains domestic. A very large work may in fact be written at a domestic scale level. It may be said that "*Gibbon's The Decline and Fall of the Roman Empire* is conceived on a massive scale" when all that is meant is that the work is long and substantial - of great size. Yet a much shorter work may have that monumental quality which indicates a large scale. The letter to Ephesians,

for example, is about one third of the length of the letter to Romans, but the scale of Ephesians is about one and a half times that of Romans. This is reflected in sentence length which is the best measure of the texture of the material.

## 1.9 Overview

The introductory chapter has been of some length as it has been necessary to provide the widest possible perspective from which to view scale in literature. Scale has been explored in cosmic terms, in human terms, in terms of architecture, music, theology, art and photography. In these areas the manifestations of scale are often visible; in literature parallel manifestations are largely hidden, and must be revealed by graphical methods.

Chapter 2 describes the techniques developed to portray graphically the underlying structure of literary works. Each work has its own distinctive "shape" in terms of sentence length distribution, and the works of each author cover a different range of shapes. Likewise, the ASL of the works of each author lie within a particular range. There is a certain amount of overlapping, both in shape and in ASL, between the works of different authors, but by comparing the ranges graphically, it is seen that sentence length distributions and sentence length averages have a certain amount of discriminating power, both when applied individually and when combined. Sentences may also be taken in sequence rather than sorted into a distribution pattern of sentence lengths. Each work provides a unique sentence sequence pattern, but certain types of sequence may be found to recur in the works of one author. They may recur at different scale levels, that is, they produce similar patterns but of different sizes. Different types of sequence pattern are explored in later chapters. This chapter establishes the procedures by which these different kinds of comparison are made, and gives examples of each type of procedure. Finally, word distributions are also considered using similar methods.

In Chapter 3 the test material drawn from modern English and ancient Greek authors is examined in ways which are quite different from those which are commonly followed in statistical studies. Most statistically based



studies concentrate on the relative frequency of occurrence of various features, with little reference to the content of the text and its genre. In these present studies, the sentence sequence patterns are carefully related to the text, and the changes in scale are traced from section to section. The changes in genre which result in these internal changes of scale are identified. Whereas statistical studies are mostly concerned with the occurrence of minutiae, these studies identify structures in the intermediate range, that is, in between syllable size and the pattern of the overall structure of the whole work. Areas of overlap and areas of discrimination between the ranges of different authors are charted, and features regarding punctuation and sentence extension are noted for development in subsequent chapters.

In Chapter 4 scale is examined in detail. The element of scale is quantitatively identified in sentence distribution patterns, in methods of sentence expansion, and in sentence sequence patterns. A particular class of sentence sequence pattern is labelled a "prime pattern" as it appears to be related to material prepared in the mind of the author and dictated or written out in one operation. It is distinct from other "secondary" patterns which refer to afterthoughts or additional material. Consideration of text division and text sampling finds that the modified full stop sentences and block sampling techniques used in statistical studies may be affected by scale changes: this suggests that some inferences which have been made in the past may not be valid. A study of the homogeneity of test samples reveals inconsistencies in the results obtained by statistical methods, and shows that it is essential to give attention to changes of genre and scale within works. The problems of dealing with questions, quotations and lists are examined, and finally a brief study is made of scale in relation to word distribution.

In Chapter 5 the method of text division is established using the UBS version and Souter's edition. The "prime patterns" are identified in five epistles each of which comprises a whole prime pattern and requires little adjustment to the text (Philippians, Colossians, 1 and 2 Thessalonians and Philemon). Data derived from these are then used to identify other prime patterns which are embedded in mixed material. Evidence of a common scaling construction is found in all the Pauline epistles. This is skewed because of the contrast between the scales of the opening and closing sections, but it also exhibits a surprising symmetry. From the characteristics found in one group of epistles, a mathematical model is designed which

demonstrates the common scaling pattern which links all the Pauline epistles. The disturbance of the texts of the Pastorals is examined and solutions proposed. Finally, the corpus is reviewed and a new method of classifying the Pauline texts is proposed.

In Chapter 6 certain similarities in the graphs of Hebrews and 1 and 2 Peter are explored. Secondary material is identified in 1 and 2 Peter, and a major correspondence is found in a long series of graphical motifs common to all three epistles, but appearing at different scale levels. A search through the graphs of texts totalling over 400,000 words fails to find any comparable series, and its occurrence three times within 8,000 words must be regarded as significant.

The implications of these recurring patterns in the Pauline epistles and in the Hebrews/1 and 2 Peter group are discussed in Chapter 7. Several possible origins of the prime patterns are examined, including the possibility that one author is responsible. The highly individual characteristics of the Pauline sequence patterns are examined, and it is shown that to imitate these patterns, very precise criteria would have to be met. The possibility that the Hebrews/1 and 2 Peter group come from one hand is also considered, and the positions of changes in scale, which are located precisely and proportionally in all three epistles, are determined.

In Chapter 8 some important features of the study are reviewed. Some suggestions are made concerning future work which might be undertaken through statistical analysis and by linguistic and literary scholars. While scale in literature should be of interest to scholars following many disciplines, my particular interest is the ministry of the Gospel and the necessity of possessing a sound working hypothesis regarding the Scriptures of the New Testament. My conclusions are therefore framed in the form of modifications to the working hypothesis which has served me, with periodic revision, throughout my ministry.

The precise nature of the skewed form of sentence length distributions still proves to be elusive, although recent statistical work does achieve more consistent results. My study of the graphical form which such distributions assume is given in Appendix A. A comparison of sentence distribution patterns and the patterns of chaotic series is given in Appendix B.



## CHAPTER 2

# Graphic Representation of Texts

In this chapter the methods of representing texts graphically are described. Where no code of practice exists, every researcher using graphical methods has to make certain decisions regarding the scales which are used in graphs. The methods adopted in preparing cumulative sum graphs of sentence distributions, word distributions and sentence sequences are here described in detail so that anyone wishing to replicate any of these exercises may produce graphs of similar proportions.

The sentence sequence of every work of literature has its own unique "shape", that is, its particular composition of sentences of different lengths. It is demonstrated in this chapter how graphs may be used to show the "shape" of a sentence sequence, and how works may be compared according to their shapes. The range of shapes typical of an author can be seen at a glance by superimposing the sentence sequence graphs of his works, all drawn on a standard base. Alternatively, the relative sizes of his works may be taken into account, in which case the base line for each graph is adjusted according to the average sentence length (ASL) of the work.

Another way of comparing works is by sorting the sizes of the sentences from longest to shortest, and comparing the resulting sentence distributions. The shapes of the distributions of different works may be compared by superimposing the distribution graphs, all drawn on a standard base - this compares shape alone. Size may also be taken into consideration by scaling the base of each graph in proportion to the ASL: this shows the

distribution range for each author. A comparison of different authors' ranges may be made by superimposing the distribution curves lying at the limits of each author's range. Word distribution graphs may be prepared in a similar way, showing the relationship between the batches of words of every length. Each of these procedures outlined above enables a different kind of comparison to be made, and examples of these various procedures will be given one by one.

Certain decisions had to be made regarding the use of computers and machine readable texts. A computer with a super CVGA monitor screen providing a maximum resolution of 1024 x 768 was available. This proved to be insufficient to give an accurate graph of the longer works which I proposed to cover. A modest drawing board of A3 size provides about double the resolution when working with an architect's customary degree of accuracy. Minitab proved to be useful in doing calculations of cumulative sums but Minitab plots were too inaccurate to give more than a general indication of the shape of a graph and tended to accommodate the graph to the computer screen. It was necessary to have complete control over the scales and dimensions of the graphs. The important graphs were drawn by hand, mostly to A3 size and reduced by photocopier. It is a laborious process, as each graph requires different scales, but the "hands-on" experience proved valuable as in the process many leads were suggested which were followed up. These would have been missed if the graphs had been prepared on a more sophisticated CAD machine.

In the early stages, some use was made of the grammatically tagged texts of the New Testament letters edited by Barbara and Timothy Friberg. The version of Ecce for MS-DOS produced by G. Toal of Edinburgh University was useful in manipulating these texts. These data, however, are not included as I decided to concentrate on two other versions and to compare word counts in detail, accounting for all differences. It proved to be all too easy to introduce minor corruptions into the text when using the computer programmes and I found more confidence in handling the texts directly with appropriate checks.

In the hand counts of words in the English texts, a double check was made of the counts of any sentences which appeared to be substantially longer than the average. The non-Biblical Greek texts were hand counted

both as modified full stop sentences (MFSS) and as full stop sentences, and the counts reconciled. In the case of the New Testament texts, the Friberg texts were used to make a complete survey based on MFSS, but this was later abandoned when it was found that MFSS did not provide a reliable representation of the scale structure. Hand counts were made of both Souter's version and that of the Third Edition (Corrected) produced by the United Bible Society (UBS). All differences were identified, thus securing a high degree of accuracy. The final UBS counts were checked against the Table provided by Kenny [35, p. 14] based on Davidson's computer count of the Fribergs' text. It is considered that these procedures ensured a degree of accuracy appropriate to the use which was subsequently made of the various texts.

## 2.1 Cumulative Sum Graphs

A cumulative sum (CS) graph is a device for displaying the "shape" of a series of numbers which might represent many things such as the lengths of sentences in a work of literature, the intervals between drips in a water drip experiment or the daily sales record of some commodity over a period of days or weeks. A simple indication of the shape of a piece of literature can be obtained by plotting the number of words in successive sentences against the sequence of sentences from first to last. The pattern of variation, however, is better displayed by plotting the cumulative sum of variations from average sentence length. A sample is given on page 46 in which a dozen sentence lengths were selected at random. It will be seen that the CS chart smooths out the variations from sentence to sentence.

A.Q. Morton indicates in his book *Proper Words in Proper Places* [46] that for practical purposes the vertical height of the chart should be about 30-40% of the width. In 1965 when I first began to prepare CS graphs I decided arbitrarily that the vertical scale representing variations from average sentence length should be 5 words per 1/8 inch and that the horizontal scale should be 20 words per 1/8 inch, the sentence divisions being adjusted according to their average sentence length. In recent studies I have maintained this ratio of 1:4 so that 1965 data may be directly compared with present work. This proportion has proved to be satisfactory in practice.

PREPARATION OF CUMULATIVE SUM GRAPHS

SAMPLE OF SENTENCE SEQUENCE PATTERN

C1	C2	C3	C4
1	16	5.75	5.75
2	23	12.75	18.50
3	6	-4.25	14.25
4	7	-3.25	11.00
5	5	-5.25	5.75
6	9	-1.25	4.50
7	14	3.75	8.25
8	15	4.75	13.00
9	3	-7.25	5.75
10	10	-0.25	5.50
11	11	0.75	6.25
12	4	-6.25	0.00

- C1 - Sequence of sentences
- C2 - Lengths of sentences
- C3 - Variations from average length
- C4 - Cumulative sum of variations from average sentence length

Sum C2 = 123.00

Mean C2 = 10.25

Subtract 10.25 from C2. Put in C3.

Parsum C3. Put in C4. Plot C4 against C1.



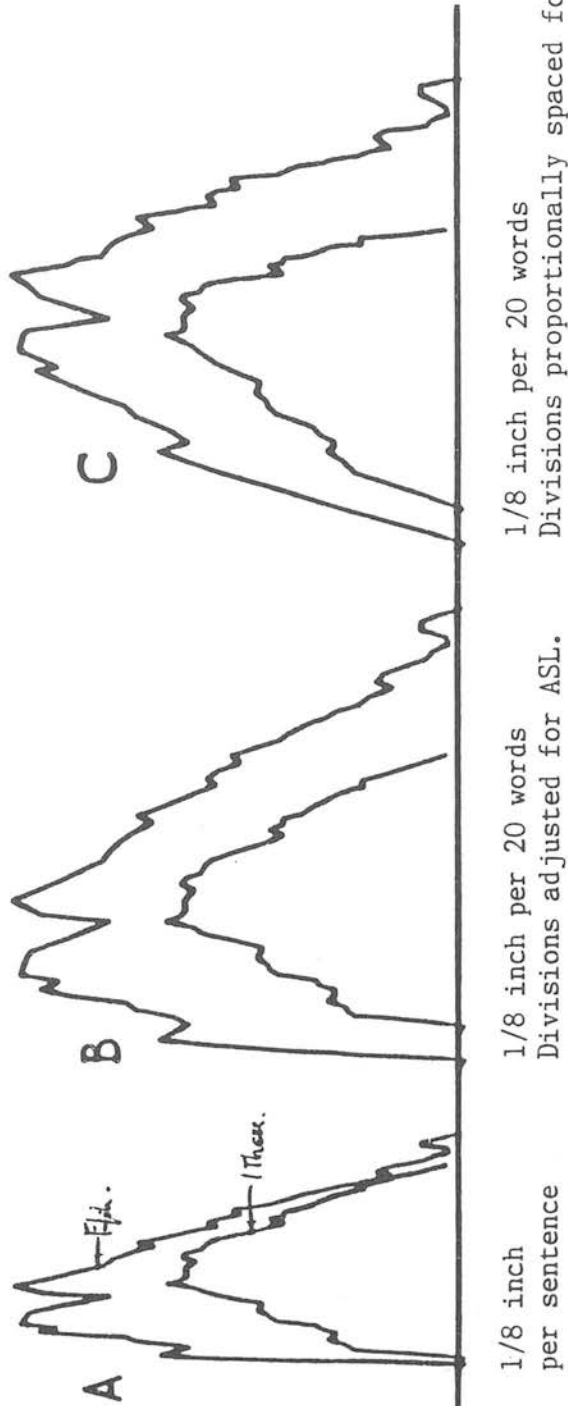
For comparative purposes the method of plotting CS graphs requires further consideration as the ASL of each work is different. A comparison of three methods is shown on page 48 where the graph of the New Testament letter to Ephesians is compared with 1 Thessalonians. In each case the vertical scale remains constant at 40 words per inch on the original drawing. The horizontal scale varies. In example A the horizontal scale is 1/8 inch per sentence. In example B the horizontal scale is 1/8 inch per 20 words, the scale divisions being varied according to the respective average sentence lengths. In B the lengths of the two letters are shown in the correct relative proportion: this is not the case in example A. Some computer programmes give the equivalent of example A providing shapes which cannot be validly compared. Other programmes make the scale fit the screen, again giving distorted shapes which cannot be compared. While B shows the correct relative overall lengths, the distribution within each graph does not show the correct relationship of sentences to each other as each sentence is given the same value along the base line. In example C the horizontal scale is again 1/8 inch to 20 words, but the sentence divisions are varied in proportion to the length of each successive sentence. This gives an accurate representation of both the overall shape of each letter and of the internal distribution of sentences. It is, however, extremely laborious to prepare, and for most practical purposes type B is adequate and can be plotted by computer within the limits of the programme.

## 2.2 Sentence Sequence Graphs

If a comparison is to be made between two works in terms of both shape and size, then the vertical scales of the graphs (representing the cumulative sum of variations from average sentence length in terms of words per inch) will be the same in each case. Likewise the horizontal scales (representing the sentences) will be the same in terms of words per inch, but the divisions will be adjusted to take account of the different average sentence lengths. The base lines will therefore be of different lengths and will be in proportion to the lengths of the two works. Such a comparison between the letter to Titus and 2 Thessalonians is shown on page 49. Both letters in the version produced by the United Bible Societies happen to have 27 sentences but they have different average sentence lengths.

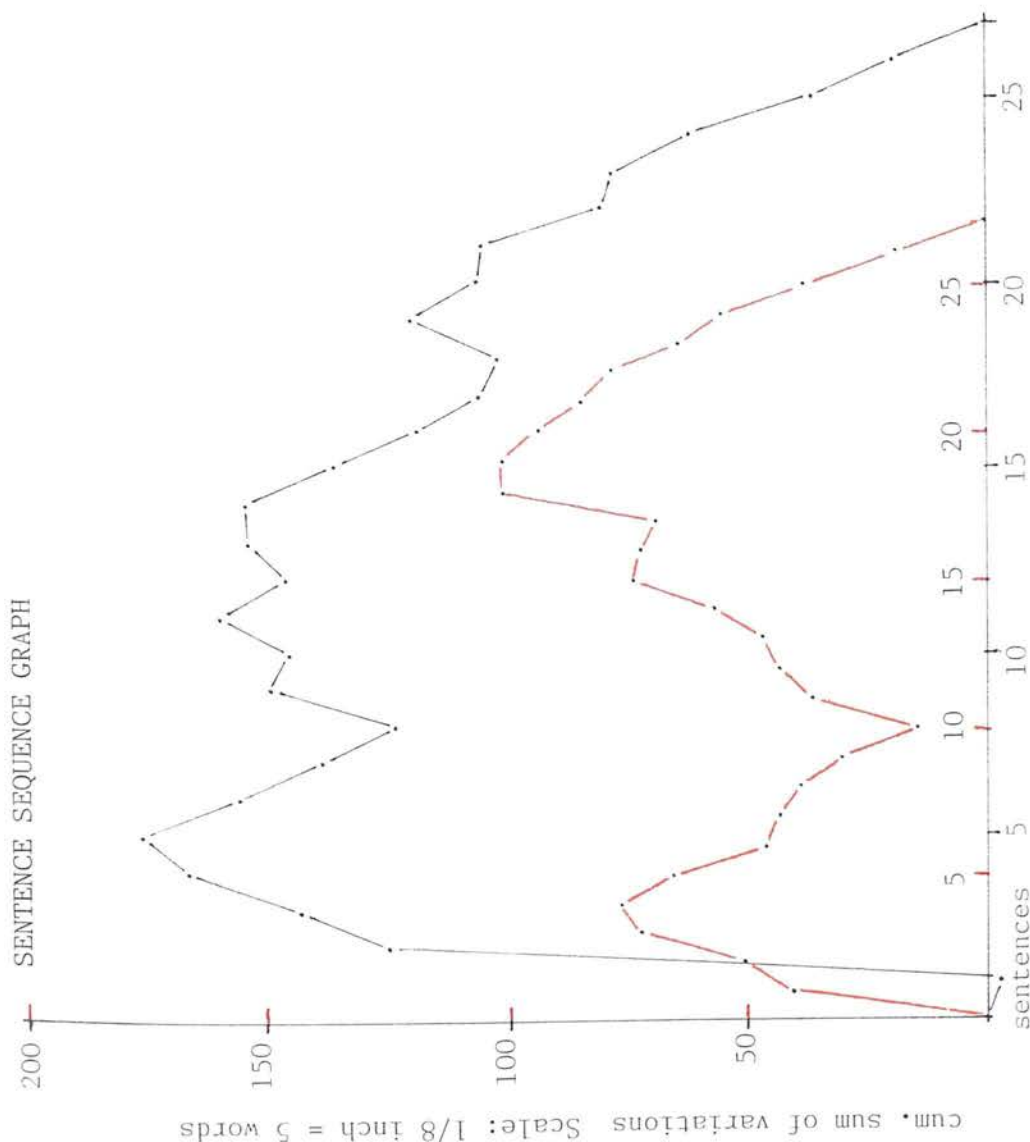
Cum. Sum of variations. Scale: 40 words per inch.

# PREPARATION OF CUMULATIVE SUM GRAPHS COMPARISON OF EPHESIANS AND 1 THESSALONIANS



(Note: Graphs shown at reduced size)

# SENTENCE SEQUENCE GRAPH



TITUS ASL: 24.41  
 1/8 inch = 20 words  
 2 THESS. ASL: 30.48

## COMPARISON OF SHAPE AND SIZE OF TWO WORKS

- TITUS UBS punctuation. 659 words. 27 sentences.
- 2 THESSALONIANS UBS punctuation. 823 words. 27 sentences.

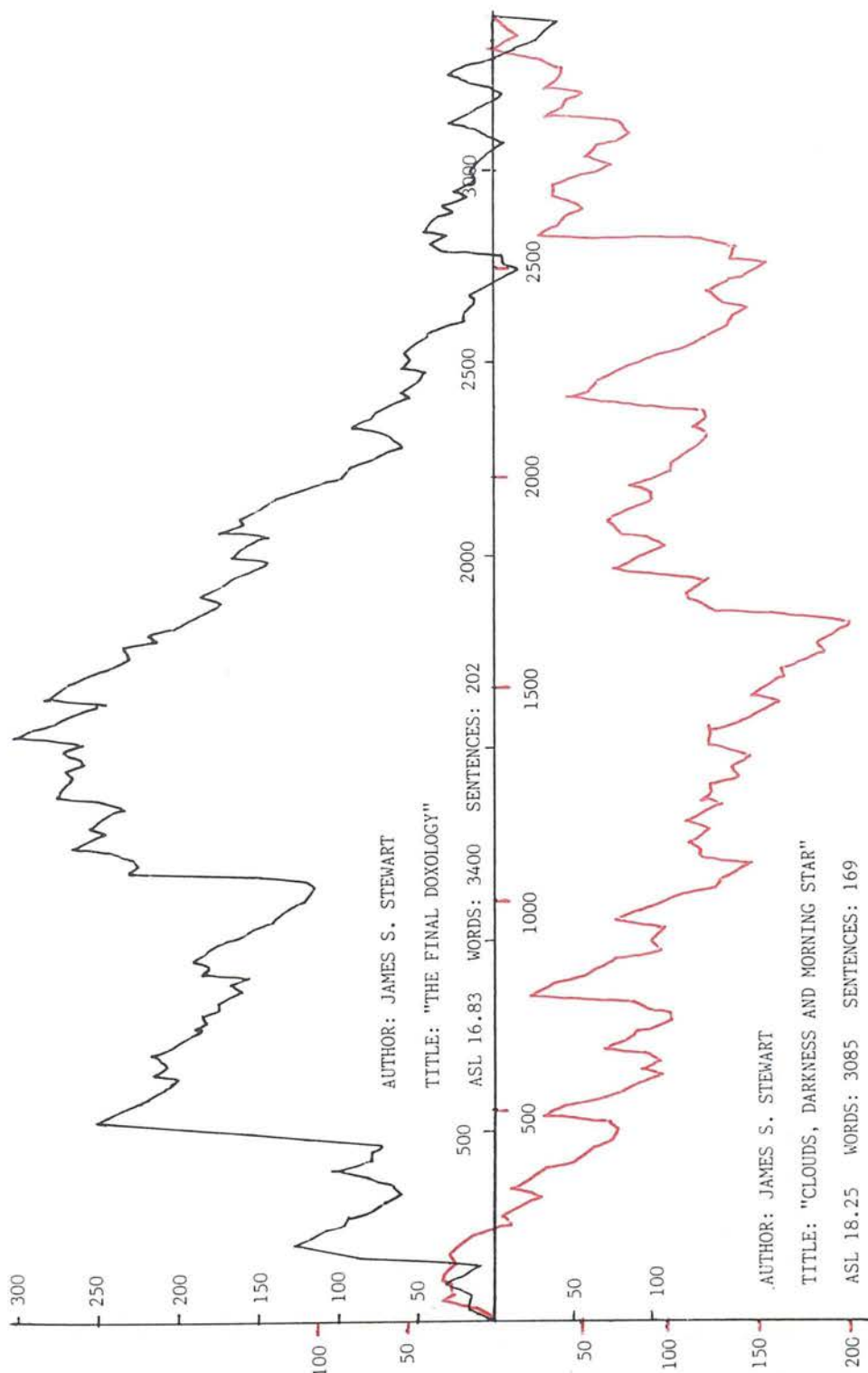


If the comparison is to be made in respect of shape only, then the CS graphs will be drawn on a standard base and the vertical scale will be adjusted to maintain the correct proportions. An arbitrary decision must be made concerning the size of the standard base. To provide this, a story by O. Henry entitled *Between Rounds* [3] was selected for the simple reason that out of the many works that had been examined, that story was the only work which provided an overall length in terms of words which was exactly divisible by the number of sentences, thus providing a whole number for the ASL. A length of 2058 words divided by 147 sentences gave an ASL of 14 words exactly. I chose to make the scale of the horizontal axis 1/10 inch per sentence of 14 words. This provided a base line of 14.7 inches which fitted conveniently into an A3 sheet. This established the horizontal scale of the control sample at 140 words per inch. To maintain the same ratio between the horizontal and vertical scales which I had used in 1965, required that the vertical scale should be 35 words per inch (25% of 140). To fit the CS graph of any work to this base requires therefore that the standard base of 14.7 inches be divided by the number of sentences to form the horizontal scale. The corresponding vertical scale will therefore be:

$$X = 35 \times \frac{\text{length of work in words}}{2058} \text{ words per inch}$$

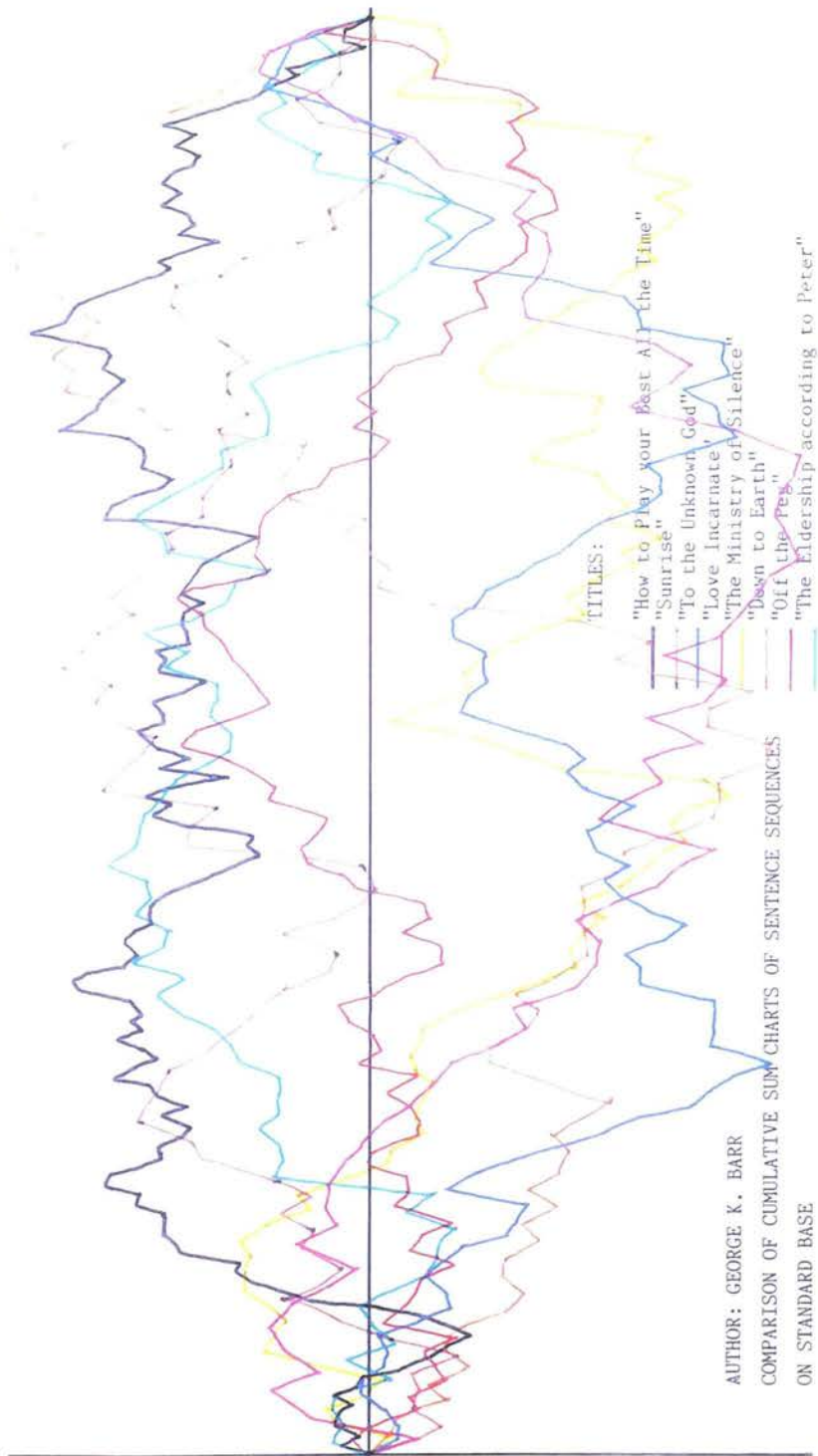
A comparison is shown on page 51 between the shapes of two works by J.S. Stewart by comparing the CS graphs of their sentence sequences drawn on a standard base. To provide all the data needed to compare several works on one chart it would be necessary to provide different scales for each work. This becomes difficult if a dozen graphs are to be superimposed. If the interest is only in comparing shapes then the details of scales may not be important and for practical purposes may be omitted, providing it is made clear that the vertical axis represents the cumulative sum of variations and the horizontal axis represents sentence units. A sample showing the comparison of sequence sentence graphs of eight of my sermons is shown on page 52. Details of the individual graphs of these sermons, with full apparatus, will be found in Chapter 5.

Cumulative sum graphs may serve many purposes, and the purpose of the collage on page 52 is quite different from that of the comparisons of



COMPARISON OF SHAPE OF SENTENCE SEQUENCES IN TWO WORKS BY JAMES S. STEWART





Cusum charts made by Morton and criticised by Holmes [31]. Morton and Holmes were attempting to identify alien material by comparing Cusum charts based on various features such as words with initial vowels. Different authors have different habits regarding such features, and to a limited extent, insertions of alien material might cause displacement in the chart. The weighted Cusum test proposed by Holmes performed marginally better than Morton's Cusum test, but still did not give consistently reliable results.

The purpose of the collage shown on page 52 is quite different: it is to provide a visual overview of the sentence structure of a whole set of samples. This will later be compared with collages of the works of other authors, and will be seen to be helpful in identifying certain patterns which occur in one author's work and not in another.

## 2.3 Sentence Distribution Graphs

The distribution of sentences of different lengths may be expressed in several ways. In the 1960's A.Q. Morton produced tables showing the distribution of sentences within various bands, from 1-5 words, 6-10 words etc. It is very difficult to make comparisons between different works by examining these tables. An example is given on page 54. Expressing the figures as percentages of the whole work gives a slight improvement but translating them into bar graph form shows how crude the bands are. Combining the 6-10 and 11-15 bands renders Philipians indistinguishable from Hebrews. A bar graph of a longer work by James S. Stewart, shown on page 55, which records sentences of every length, demonstrates the problem posed by gaps in the distribution, that is, where there are no sentences of one particular length. It is very difficult to judge the significance of isolated long sentences. A graphical method was needed through which the length of every individual sentence would be reflected in the graph. This was achieved by sorting the sentences in order from longest to shortest and plotting a CS graph of the resulting sequence. This is referred to as a "sentence distribution graph" as distinct from the "sentence sequence graph" described in sections 2.1 and 2.2. A sample showing the construction is given on page 56, and a typical graph of a longer work is shown on page 57. In this graph the longest sentences are reflected in the first steeply rising part of the curve. Sentences

# THE SENTENCE LENGTH DISTRIBUTION OF THE PAULINE CORPUS

## NUMBERS OF SENTENCES IN THE EPISTLES

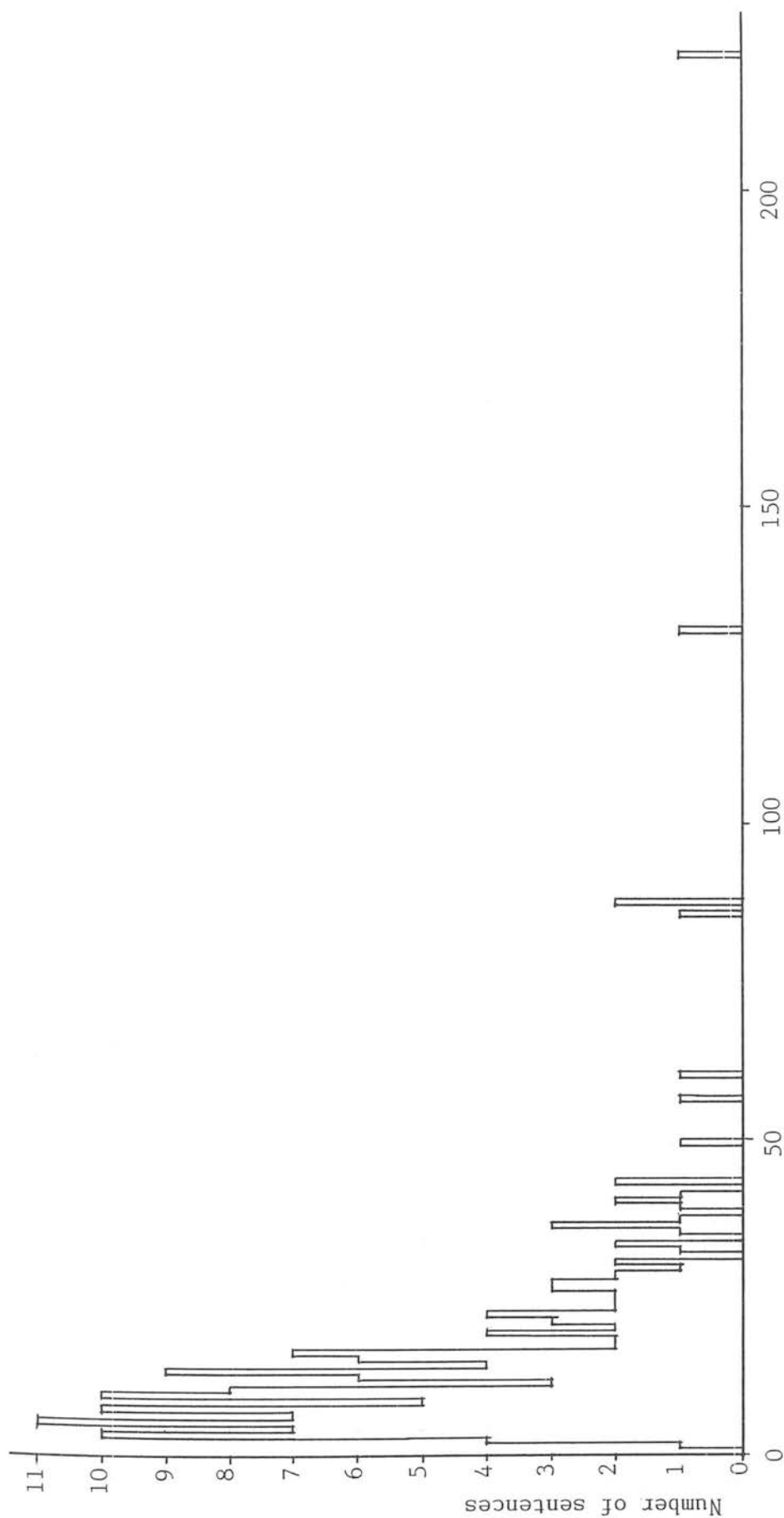
No of words in sentence	Ro- mns.	1st Cor- ths.	2nd Cor- ths.	Gal ns.	Eph- ns.	Phil- pns.	Col- ns.	1st Thes. ns.	2nd Thes. ns.	1st Tmy.	2nd Tmy.	Ti- tus	Phi- mn.	Heb- rews.
1-5	110	125	56	26	9	9	6	4	3	14	19	7	1	22
6-10	214	253	103	62	10	26	17	23	8	27	17	5	8	88
11-15	113	138	63	50	24	31	18	17	8	26	23	8	4	89
16-20	57	60	49	19	14	15	13	12	7	20	16	7	5	42
21-25	42	27	32	12	10	5	8	9	3	10	3	3	-	25
26-30	15	9	19	7	6	4	7	3	5	2	3	2	2	16
31-35	10.	9	5	1	6	4	7	6	1	2	6	1	1	14
36-40	6	1	1	3	7	3	3	2	3	2	-	-	-	6
41-45	5	2	4	-	3	2	1	-	-	1	1	1	-	6
46-50	6	3	-	-	2	2	1	4	2	2	-	1	1	4
51-55	1	-	1	-	1	1	-	-	-	-	-	1	-	1
56-60	1	1	-	1	1	-	1	-	-	1	-	1	-	1
61-65	1	-	-	-	1	-	-	-	-	-	-	-	-	1
66-70	-	-	1	-	3	-	-	-	-	-	1	-	-	-
71-75	-	-	-	-	1	-	-	-	1	-	-	-	-	-
81-85	-	-	-	-	1	-	-	-	-	-	-	-	-	-
139	-	-	-	-	1	-	-	-	-	-	-	-	-	-

No. of sentences

581 628 334 181 100 102 83 81 41 107 89 37 22 315

A.S.L. 12.23 10.85 13.39 12.34 24.15 15.98 19.02 18.16 20.05 14.87 13.91 17.76 15.27 15.69

(Sentences determined by dividing the Souter text at every colon, question mark and full stop.)



Number of words in sentence

JAMES S. STEWART - "O MAN, GREATLY BELOVED"

SENTENCE DISTRIBUTION FOR COMPARISON WITH NORMAL BELL-SHAPED CURVE

PREPARATION OF CUMULATIVE SUM GRAPHS

SAMPLE OF SENTENCE DISTRIBUTION

C1	C2	C3	C4	C5	
1	16	5.75	12.75	12.75	C1 - Sequence of sentences
2	23	12.75	5.75	18.50	
3	6	-4.25	4.75	23.25	C2 - Lengths of sentences
4	7	-3.25	3.75	27.00	
5	5	-5.25	0.75	27.75	C3 - Variations from average
6	9	-1.25	-0.25	27.50	
7	14	3.75	-1.25	26.25	C4 - Variations sorted
8	15	4.75	-3.25	23.00	greatest to least
9	3	-7.25	-4.25	18.75	
10	10	-0.25	-5.25	13.50	C5 - Cumulative sum of
11	11	0.75	-6.25	7.25	sorted variations
12	4	-6.25	-7.25	0.00	

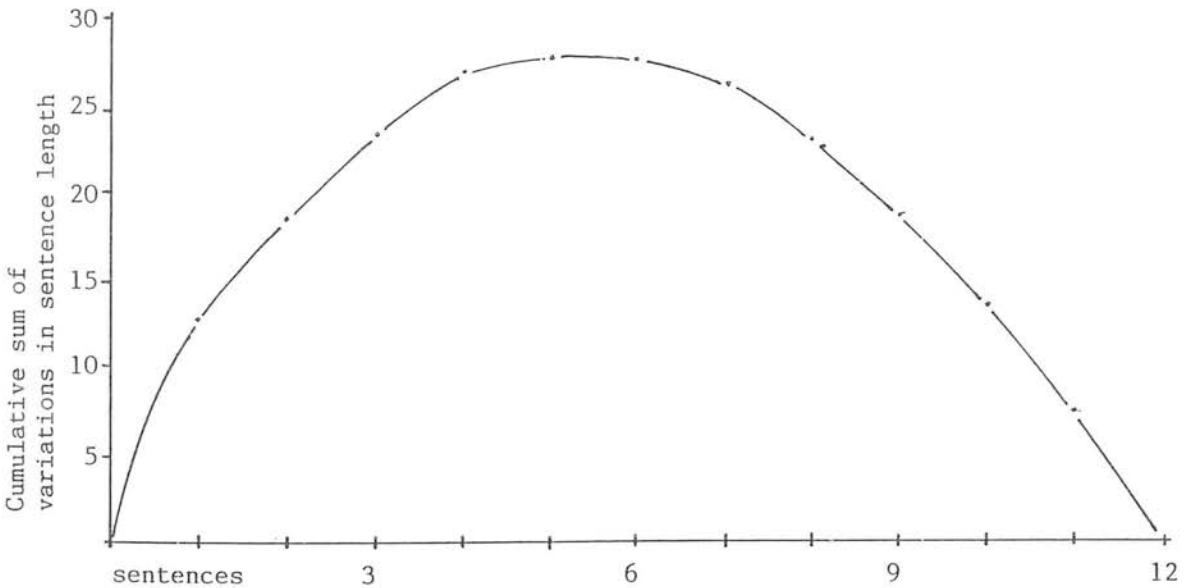
Sum C2 = 123.00

Mean C2 = 10.25

Subtract 10.25 from C2. Put in C3.

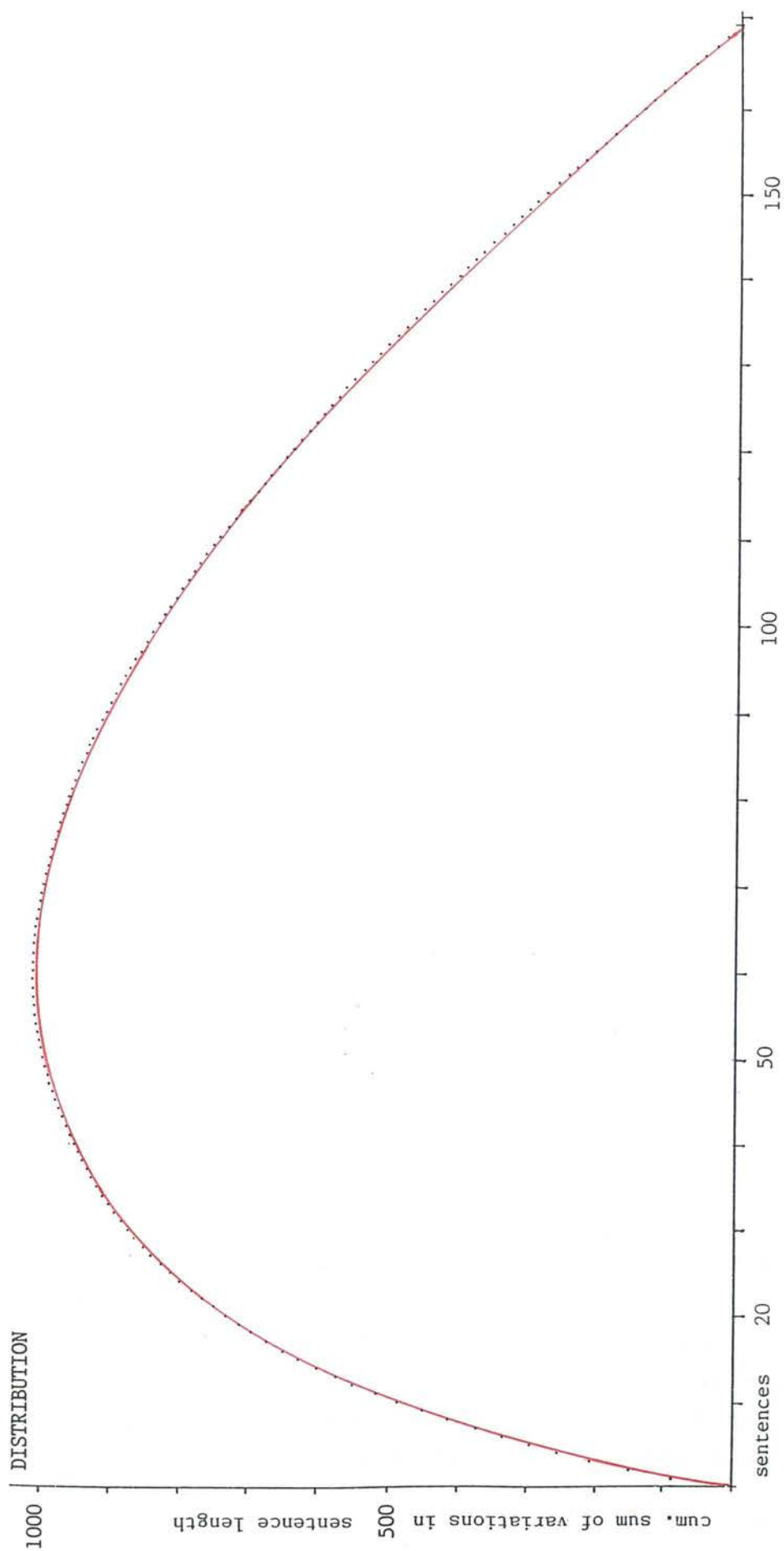
Sort C3 greatest to least. Put in C4.

Parsum C4. Put in C5. Plot C5 against C1.



Note: As the figures for these "sentences" were chosen at random the curve shows a nearly normal distribution. Sentence distribution curves usually show more skew.





AUTHOR: JAMES S. STEWART

TITLE: "CLOUDS, DARKNESS AND MORNING STAR"

A.S.L. 18.25 WORDS: 3085 SENTENCES: 169

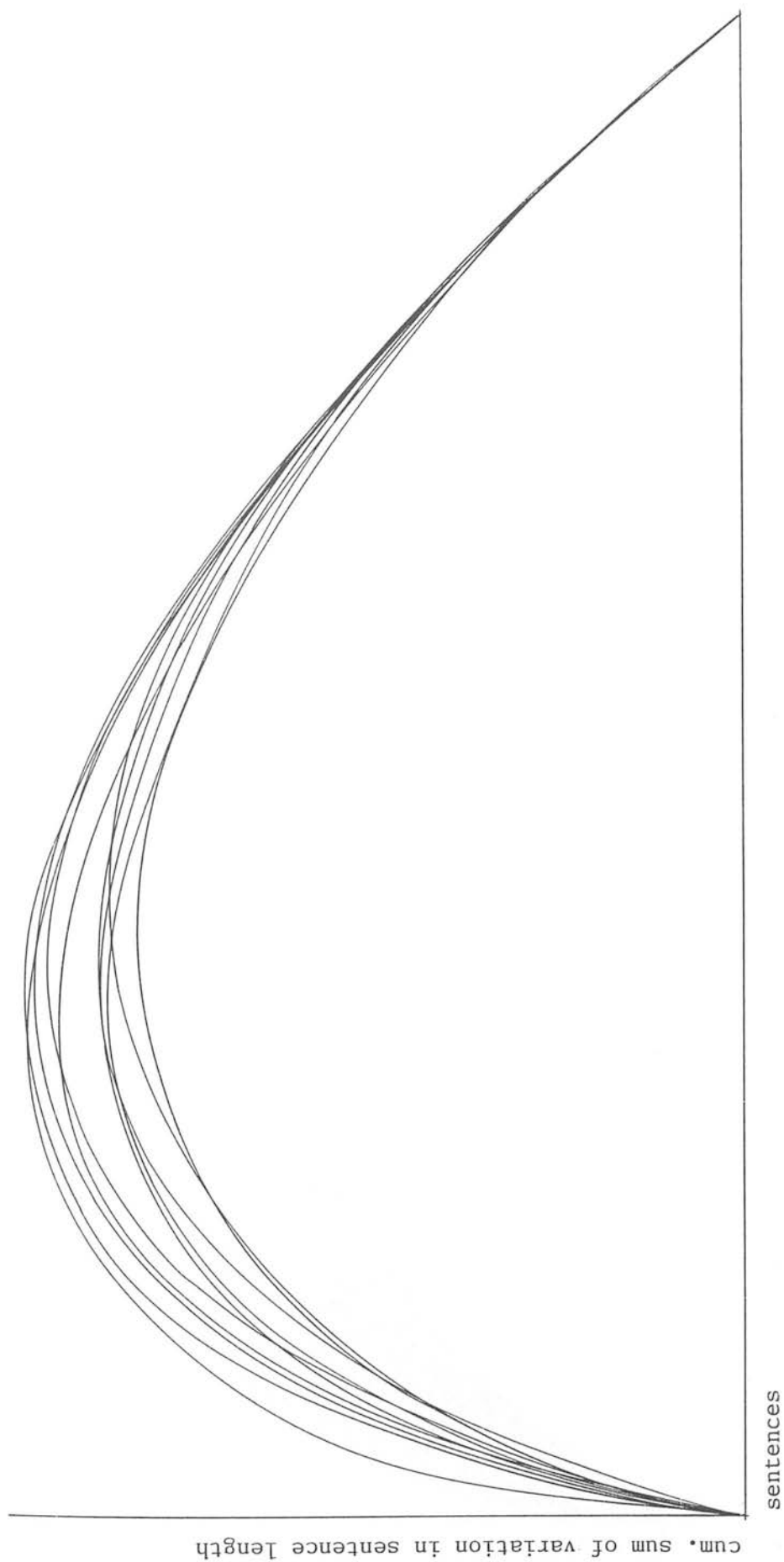
of average length form the horizontal portion at the top of the curve and the shortest sentences provide the falling curve at the right hand side. Each sentence contributes to the overall curve. It is a sensitive tool as the degree of contrast between the longer and the shorter sentences is reflected in the height of the graph, and the longer sentences affect the degree of skew. In short works facets in the curve are noticeable: these occur wherever there are two or more sentences of the same length. In longer works the facets are barely detectable. These curves are used as a working tool throughout these studies and further consideration is given to their peculiar properties in Appendix A.

To compare these distribution curves they must be plotted on a standard base and an arbitrary decision has to be made to determine the vertical scale. I adopted the same base as for sentence sequence graphs and for the control made the vertical scale 1/10 inch to 10 words of variation, i.e. 100 words per inch. To prepare a CS graph of any work for comparative purposes the base line is therefore 14.7 inches long, divided by the number of sentences. The vertical scale representing the cumulative sum of variations will be:

$$X = 100 \times \frac{\text{length of work in words}}{2058} \quad \text{words per inch}$$

A comparison of the shapes of sentence distribution in ten of James S. Stewart's works is shown on page 59. Ten different sets of scales would be required so these are omitted. The range of shapes of distribution covered by several authors may be compared by superimposing the individual distribution ranges. An example of such a comparison between the ranges of four Greek authors is given on page 60 and the overlap between authors is apparent.

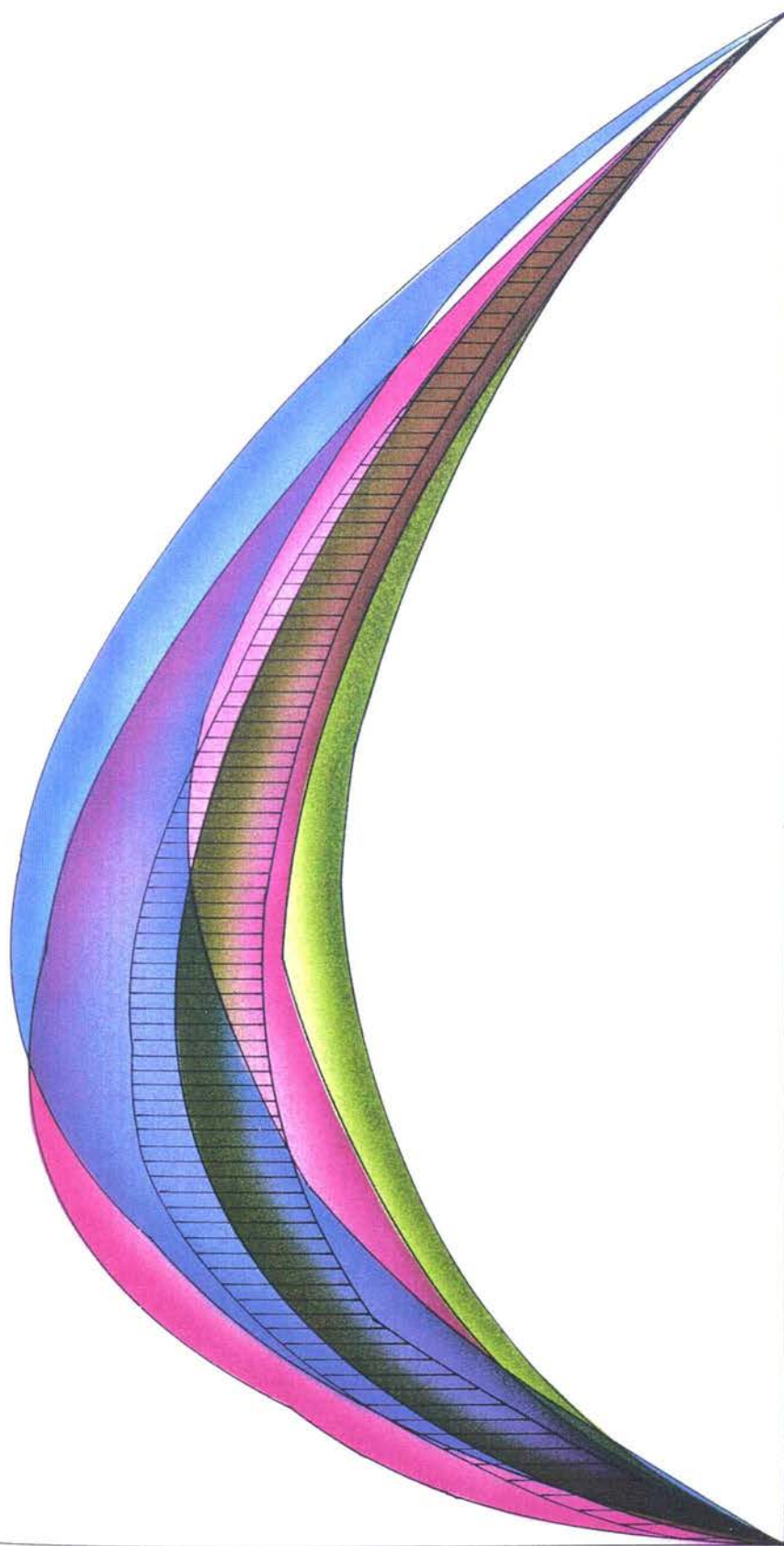
An impression of an author's distribution range can be given by plotting the distribution curves on a base line representing average sentence length. The distribution range of Isocrates is shown on page 61. The ranges of several authors may be compared by superimposing these, but in practice a clearer picture is obtained by plotting only the samples (of each author) which have the highest and the lowest ASLs. A comparison of the

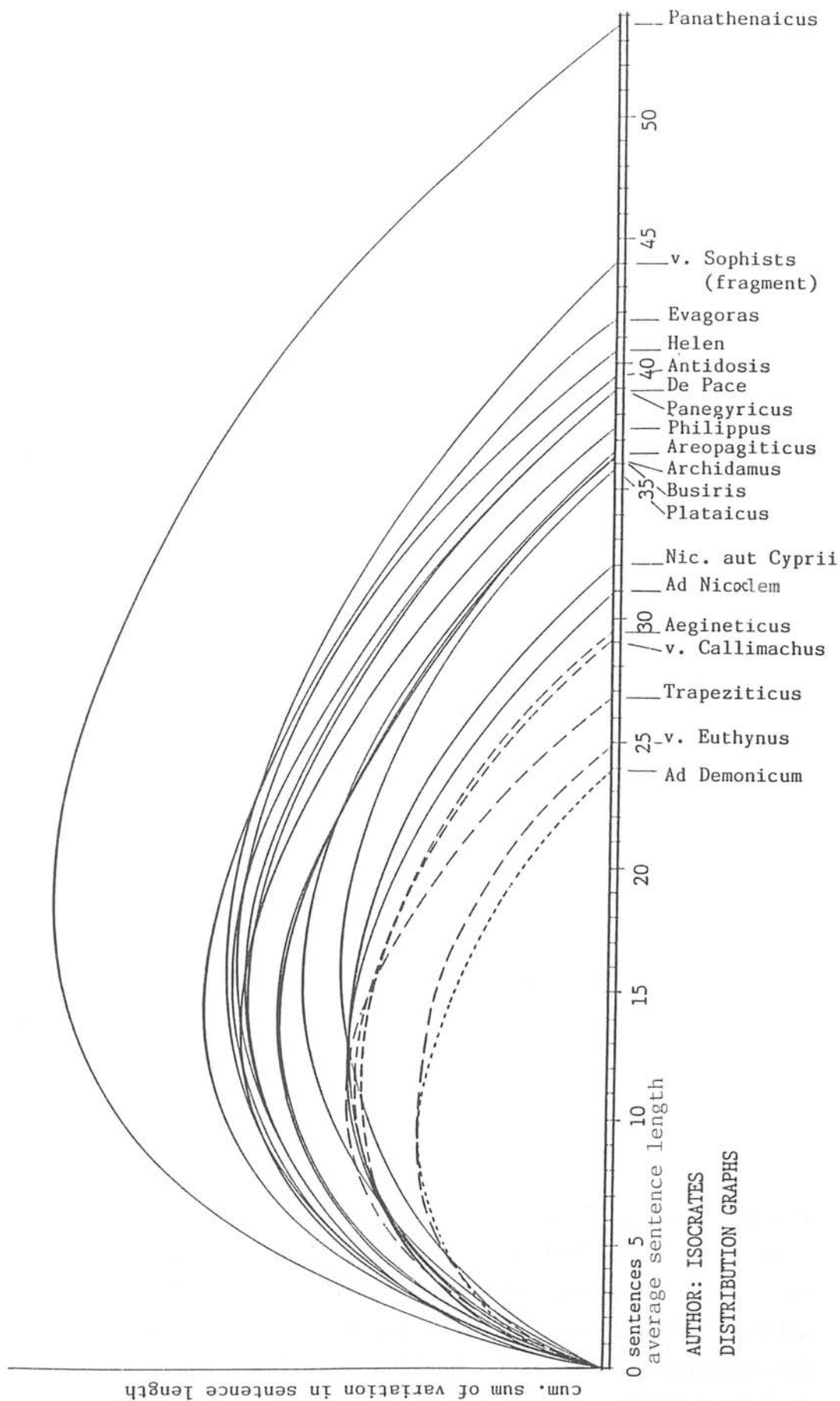


# SENTENCE DISTRIBUTION CURVES

AUTHOR: JAMES S. STEWART - 8 SERMONS AND 2 LECTURES

Cum. sum of variations in sentence length





distribution ranges of four Greek authors is shown on page 63 and the areas of overlap are clear. This drawing refers to "scale" ranges rather than distribution ranges. The justification for that term will be found in Chapter 4, page 140, where the scale element is identified. The difference between the ranges shown on pages 60 and 63 is that the former collage shows the ranges of distribution in each author in terms of the "shape" of the distribution (i.e. in terms of the proportions of sentences of various lengths), while the latter also takes into account the differences in average sentence length. In the second illustration it would be altogether too confusing to show the shape of every work, and so only the shapes of those with the lowest and highest ASLs are shown to define the limits of the range.

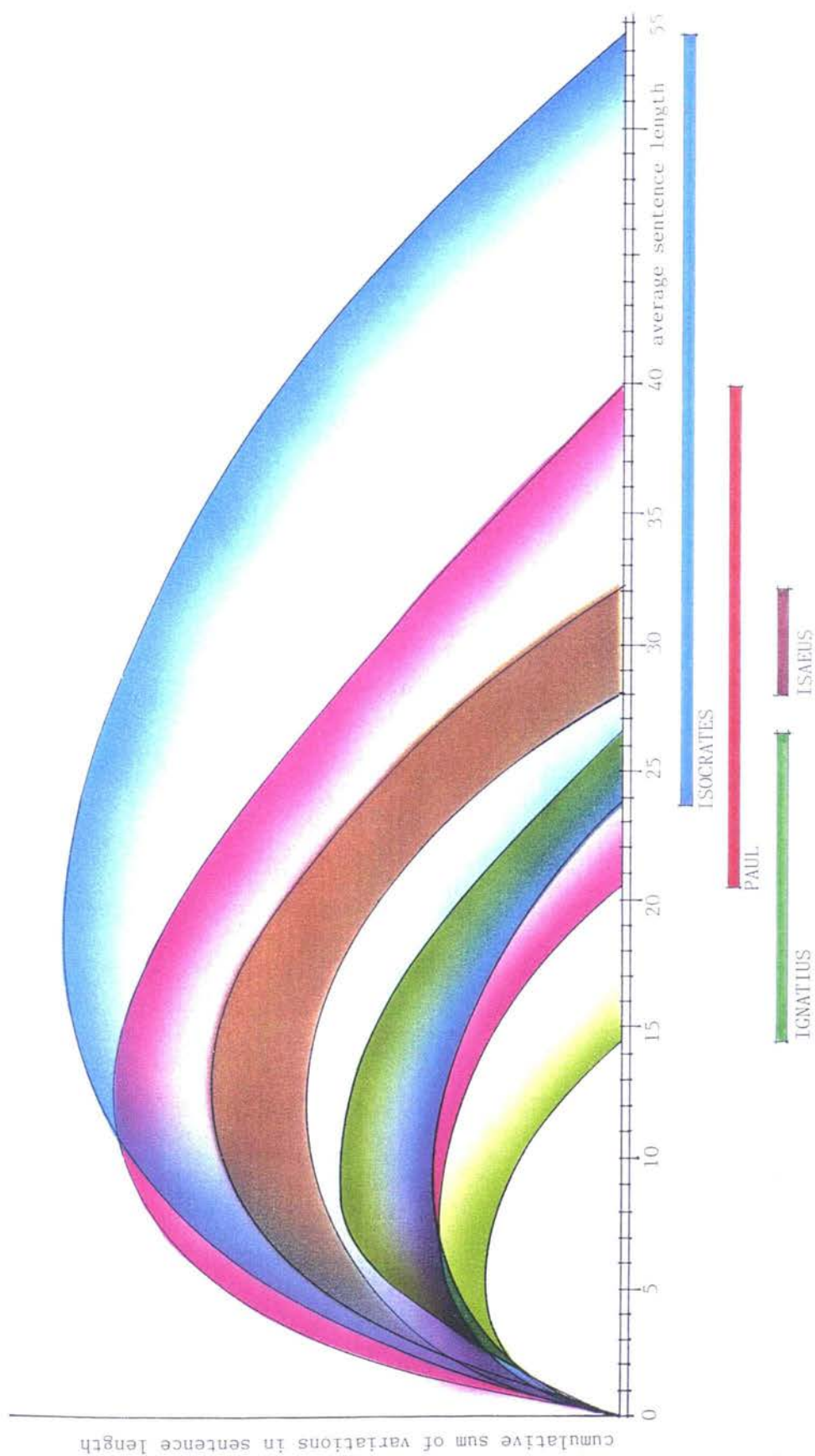
## 2.4 Word Length Distribution Graphs

Tables giving percentages for words of different lengths are not altogether satisfactory in that it is difficult to judge the effect of, say, a shortage of three letter words being compensated for by an abundance of two and four letter words. With such variations at every word length it is difficult to grasp the overall pattern. Word distribution may, however, be shown graphically in a similar way to sentence distribution. In this case the number of words in the piece is plotted against the cumulative sum of variations in word length. Again a decision has to be made regarding the relative scales. I chose to use the same base of 14.7 inches divided by the total number of words in the work. To give a graph of reasonable proportions I chose to determine the vertical scale representing the cumulative sum of variations in word length as follows:

$$X = 300 \times \frac{\text{length of work in words}}{2058} \quad \text{letters per inch}$$

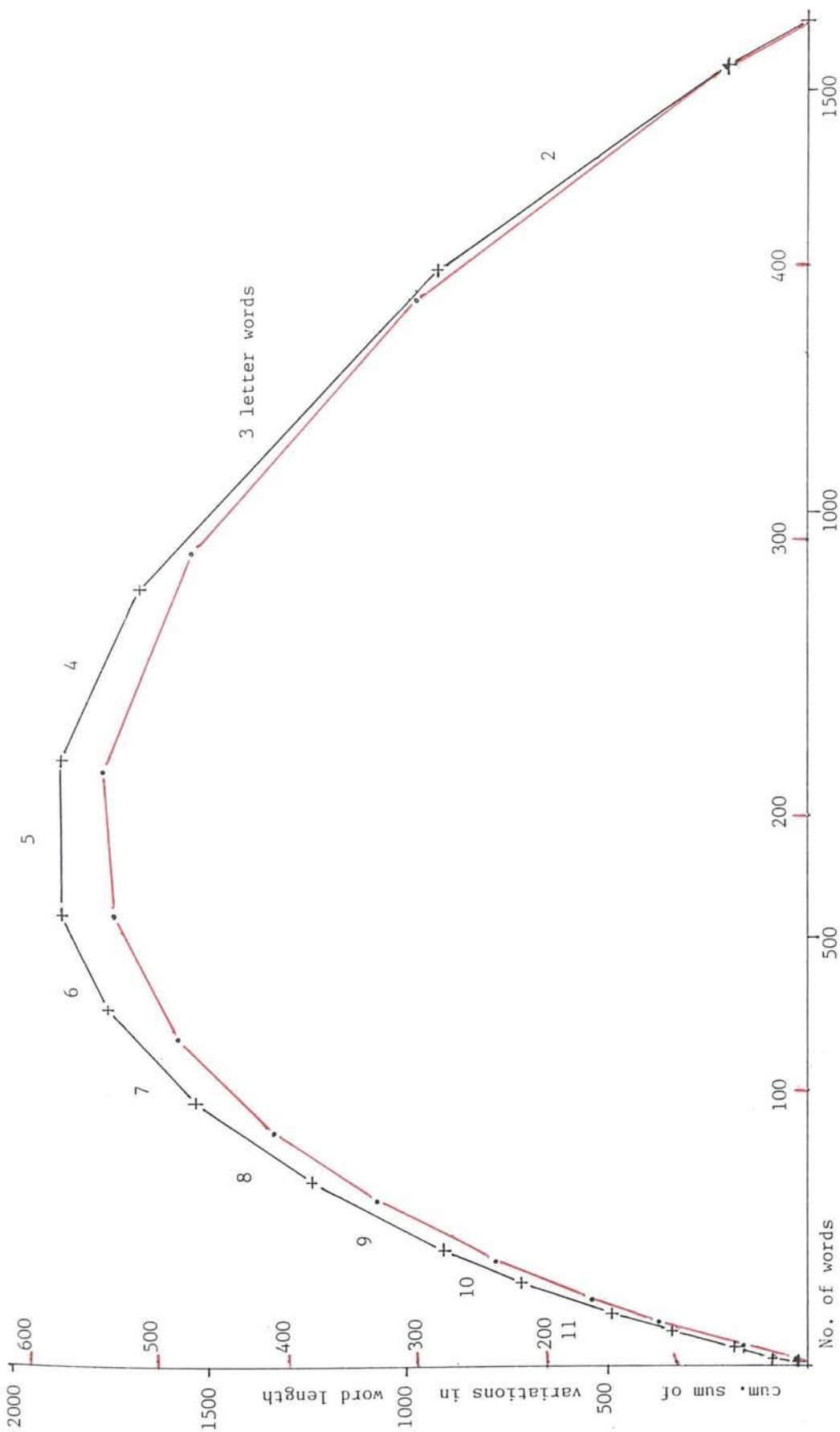
A comparison is shown on page 64 between the word length distribution in Colossians and that found in 1 Corinthians 15:1-34, two passages which, as will be seen later, have a scaling relationship. Each facet of the curve represents the number of words of a particular length. It will be seen how the shortage of three letter words in 1 Corinthians is compensated for by a greater proportion of two and four letter words. While there is a





COMPARISON OF SCALE RANGES OF GREEK AUTHORS





— COLOSSIANS - U.B.S. punctuation A.S.L. 32.9 words. Average word length 4.98 letters.  
 ••• 1 CORINTHIANS 15:1-34 - U.B.S. punctuation. A.S.L. 20.25 words. Average word length 4.86 letters.

CUMULATIVE SUM CHARTS OF WORD LENGTH DISTRIBUTION

considerable difference in the length of the two epistles and the ASL of one is more than 50% greater than that of the other, there is very little difference in average word length. The overall shape of word distribution is seen to be similar. The height of the curve gives an indication of the degree of contrast between the longer and the shorter words, and in these two letters the contrast is similar though Colossians, being much longer, has the scope to employ a richer vocabulary.

## CHAPTER 3

### English and Greek Texts

As indicated in Chapter 1 (pp. 2f.), my studies in the Pauline Epistles (in 1965) detected what appeared to be a consistent scale structure running throughout the Pauline corpus. It was difficult to assess the significance of the features noted at that time as I had no test material by other authors with which to make comparisons, except a few of my own student essays. To provide a basis for comparison, selections were made from the work of six modern English authors and three ancient Greek authors. My purpose in examining the English texts is to identify features which affect the shape of sentence sequences and distribution patterns, some of which might be peculiar to one author.

We may be reasonably sure that the punctuation of these English texts is a fair reflection of the flow of the text as conceived by the author, and that it is not unduly affected by an editor. The Greek texts present problems in punctuation which will be examined in greater detail later (see pp. 189ff.), but by taking as a basis the full stop sentences of the standard texts, cumulative sum graphs may give a useful general view of the shape of these authors' works and provide the comparative distribution ranges against which the New Testament material may be viewed. At this stage, the examination of the Greek texts has this limited aim, but data referring to scale are derived from both the English and Greek texts.

The Greek texts chosen included all the known works of Isocrates, seven letters of Ignatius of Antioch and twelve forensic speeches of Isaeus.

In selecting English authors I chose preachers, short story writers both male and female, a writer on art and an essayist, as follows:

Eight sermons and two lectures by James S. Stewart [9 and 10]

Twenty sermons of my own

Twenty short stories by O. Henry [3]

Ten short stories by Barbara Erskine [2]

Ten pieces by John Ruskin [4 - 8]

Ten essays by Thomas Carlyle. [1]

The decision to include some unpublished sermons of my own was made because I had knowledge of the circumstances under which they were written. Studying graphs of my own work played an important part in the development of my thesis. The shape of a sermon can be affected, for example, by interruptions during the writing, or by reworking material formerly used under different circumstances. It is very difficult to obtain reliable evidence from authors concerning these matters: no one keeps a record of telephone interruptions, and ministers may be reluctant to reveal details about the reuse of material. Features found in my own work were similar to features in the Pauline epistles and the comparison offered some useful insights. As these sermons are unpublished, however, the reader may prefer to disregard this evidence which cannot be verified, and to take the Pauline evidence and that of other authors, on its own merits.

In making such a selection, care has to be taken to ensure that the works do indeed come from the hand of the author and that no ghost writers are involved. In the case of these particular authors I know of no evidence suggesting that such a complication might arise. As noted above, the punctuation of the English texts may be assumed to be authorial, rather than editorial. James Stewart's unusual sentence sequences arise out of his method of handling his sermon material, rather than from syntactical considerations, and may be taken to give a true reflection of the flow of his text. My own sermons are certainly not edited. The stories of O. Henry and Barbara Erskine are vividly written and it is difficult to conceive of any

substantial editorial influence. John Ruskin was in the habit of polishing his prose, and like Carlyle, was a master in the use of complex, extended sentences. Confidence in the integrity of the punctuation must, however, be related to the use which is made of the sentence patterns. In the case of these English authors, no reliance is placed upon the punctuation of individual sentences: more importance is given to the scale of whole sections and to the contrast in ASL between different sections of a piece. Minor editorial activity would be highly unlikely to affect these contrasts significantly.

The samples of these authors' works are presented in several different ways:

**SENTENCE SEQUENCE GRAPHS** - The sentence sequence graphs of the works of each author are shown individually, all scaled to a standard base, so that the shapes of sentence sequences may be compared (for example, see page 71). A collage is also shown with the sentence sequence graphs in different colours, as the combination of all the graphs of one author's work may show up certain characteristics of the author (for example, see page 76).

**SENTENCE DISTRIBUTION GRAPHS** - The sentence distribution curves for the works of each author are shown superimposed upon a common base line: thus the shapes of the distributions within one author's work may be compared (for example, see page 70). The ranges of these shapes in respect of all the authors (that is, the extreme boundaries of each set of distribution curves) are also drawn on a common base, thus showing the areas of overlap among the various authors (for example, see page 130).

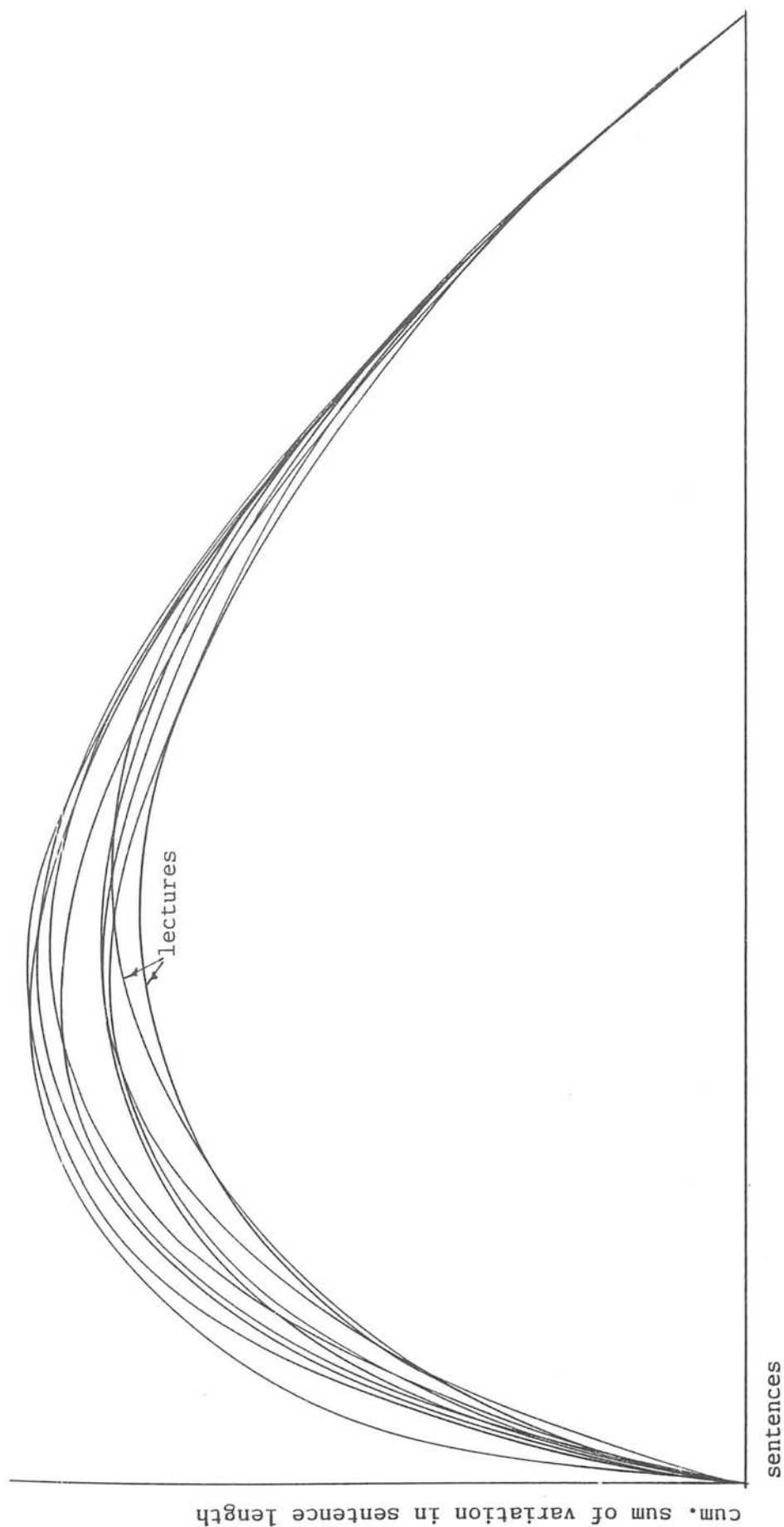
**DISTRIBUTION RANGES** - The distribution ranges are drawn on a base representing sentence length in order to show the areas covered by the samples of each writer (for example, see page 125). The distribution graphs of the works with the longest and shortest ASL from each writer are then assembled to show simultaneously the ranges covered by each author and the areas of overlap (for example, see page 132). It must be said that these distribution ranges refer to the selected works and not to the whole output of these authors. The selection of Greek works covers most of the known writings, but the English selection covers only a small proportion. Later

examination has shown, for example, that the distribution ranges of Carlyle and Ruskin extend considerably beyond the scope of these samples. It is not my purpose, however, to use these distribution ranges to discriminate between works of different authors, although in some circumstances this might be a valid procedure.

### 3.1 JAMES S. STEWART

Eight sermons were taken at random from the book entitled *The Gates of New Life* [10]. To these were added two lectures from the book *A Faith to Proclaim* [9] in order to provide a contrast between James Stewart's preaching and lecturing styles. The graphs (page 70) show that sentence distribution in the lectures has rather less skew and less contrast. The preaching style carries more punch and greater contrast in sentence length.

The sentence sequence graphs (page 71) do not show any clear overall pattern but a striking feature is the occurrence of extraordinarily long sentences, singly or in groups. These are marked by the long vertical lines on the graphs of three sermons which are shown on pages 72ff. When the sectional divisions in the text are noted, then a recurring motif is apparent. This consists of a series of sentences of around average or under-average length followed by a very long sentence or group of sentences, and ending with one or two shorter sentences. This provides a motif which is shown in schematic form on page 72. The other striking feature to note is that while a few of these very long sentences are related to illustrations of particular poignancy, the great majority have notable numinous content. They are concerned with our sense of creatureliness in the presence of God, with the mysterious presence, with the veil of the Temple and the pillars of cloud and fire which were loci of the numinous presence. (See pages 32f. for reference to Rudolph Otto and the numinous in Paul's writing.) On occasion such a passage may carry a vision on a grand scale of Mankind on the march across the ages. The content of these long sentences is indicated in the graphs on pages 72ff. There is a clear distinction to be made between passages in Stewart's sermons which refer to ordinary human life, and those which place that life in the context of the Holy. The former generally use short sentences and the latter, which have great numinous content, employ these very long



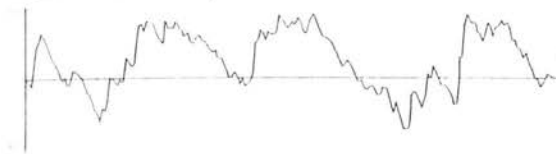
# SENTENCE DISTRIBUTION CURVES

AUTHOR: JAMES S. STEWART - 8 SERMONS AND 2 LECTURES

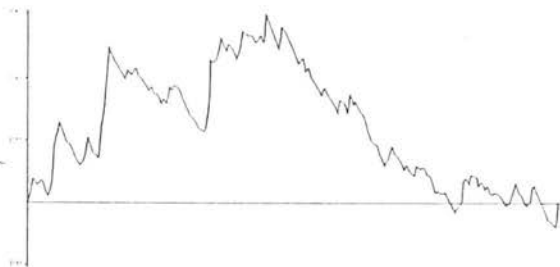


SERMONS

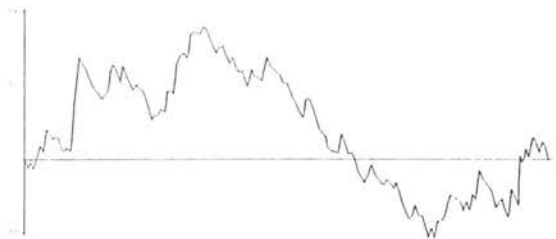
SENTENCE SEQUENCE GRAPHS



JAMES S. STEWART  
"WHY BE A CHRISTIAN"  
ASL: 15.75 3166W 201S



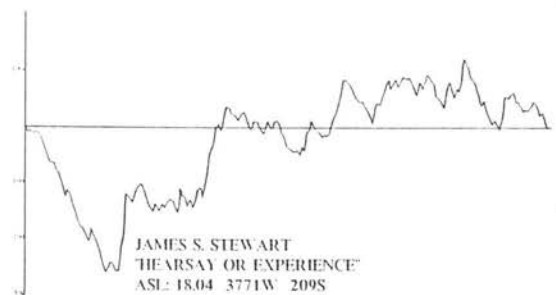
JAMES S. STEWART  
"THE FINAL DOXOLOGY"  
ASL: 16.83 3400W 202S



JAMES S. STEWART  
"VANGUARD AND REARGUARD"  
ASL: 17.47 2883W 165S



JAMES S. STEWART  
"THE LORD GOD OMNIPOTENT REIGNETH"  
ASL: 17.59 3290W 187S



JAMES S. STEWART  
"HEARSAY OR EXPERIENCE"  
ASL: 18.04 3771W 209S



JAMES S. STEWART  
"CLOUDS, DARKNESS AND MORNING STAR"  
ASL: 18.25 3085W 169S



JAMES S. STEWART  
"THE UNIVERSALITY OF JESUS"  
ASL: 19.01 3023W 159S



JAMES S. STEWART  
"O MAN, GREATLY BELOVED"  
ASL: 19.34 3172W 164S

LECTURES



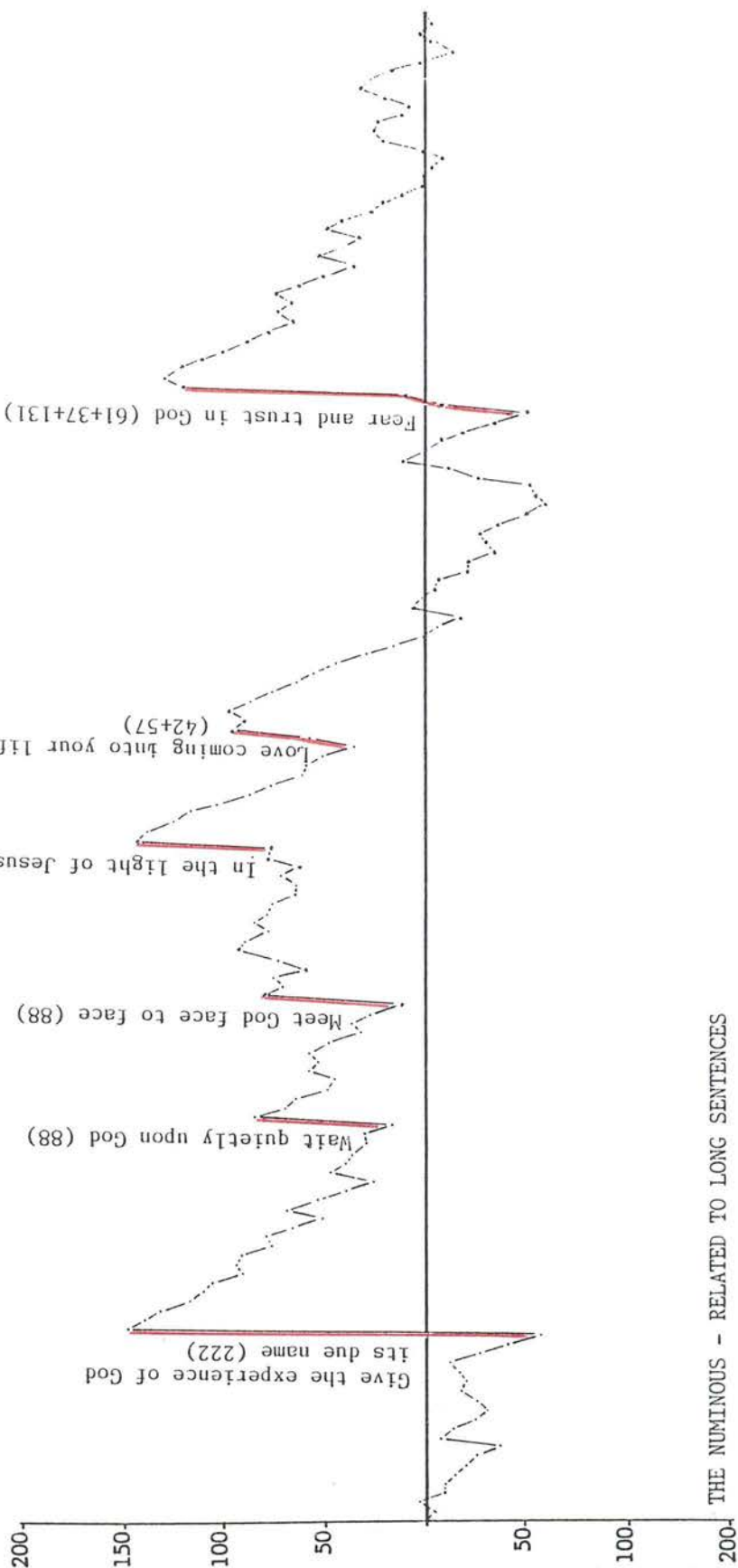
JAMES S. STEWART  
"A FAITH TO PROCLAIM" - CHAPTER 5  
ASL: 22.57 5981W 265S



JAMES S. STEWART  
"A FAITH TO PROCLAIM" - CHAPTER 1  
ASL: 26.69 9342W 350S

# SENTENCE SEQUENCE GRAPH

PATTERN



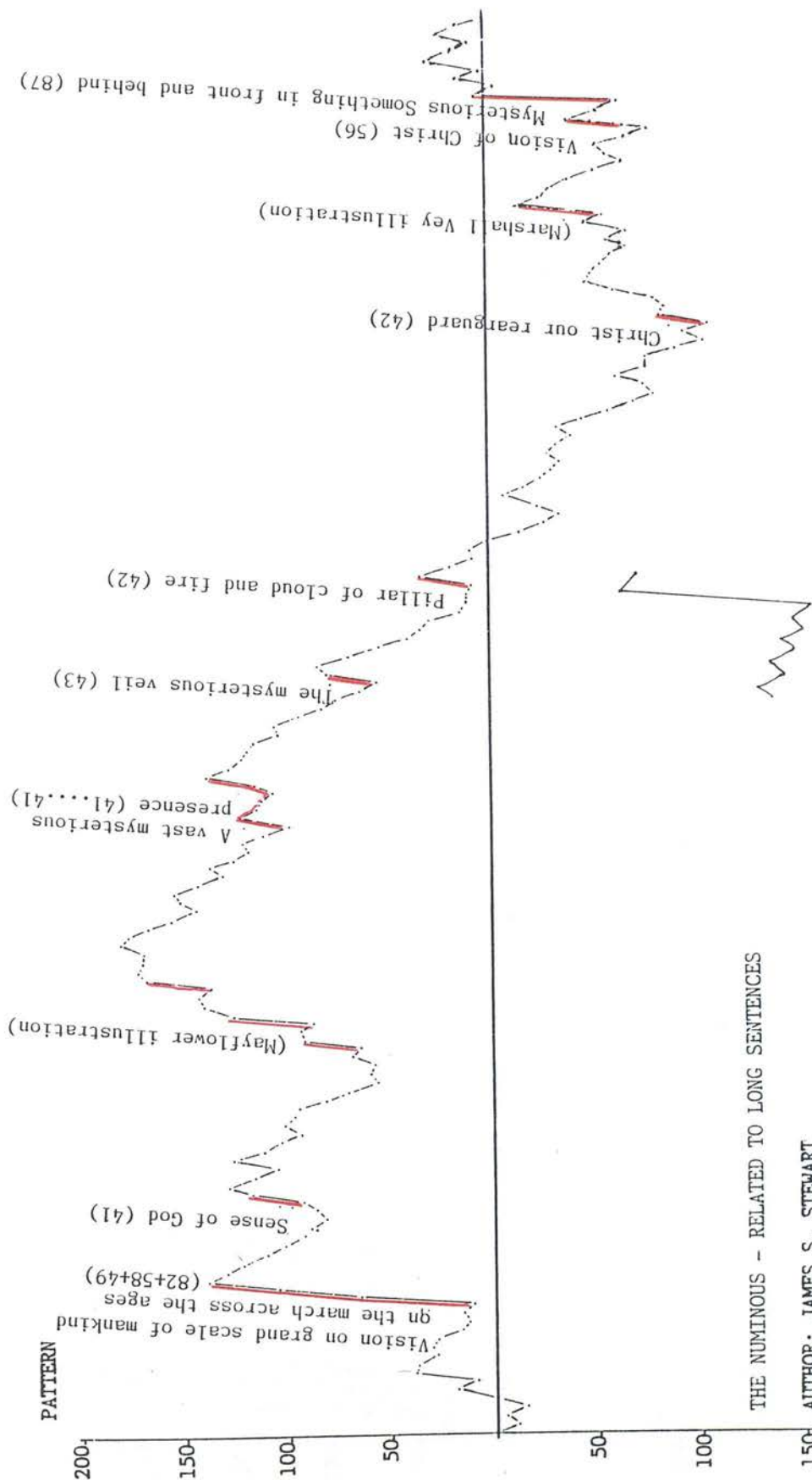
THE NUMINOUS - RELATED TO LONG SENTENCES

AUTHOR: JAMES S. STEWART

TITLE: "O MAN, GREATLY BELOVED"

A.S.L. 19.34 WORDS: 3172 SENTENCES: 164

# SENTENCE SEQUENCE GRAPH



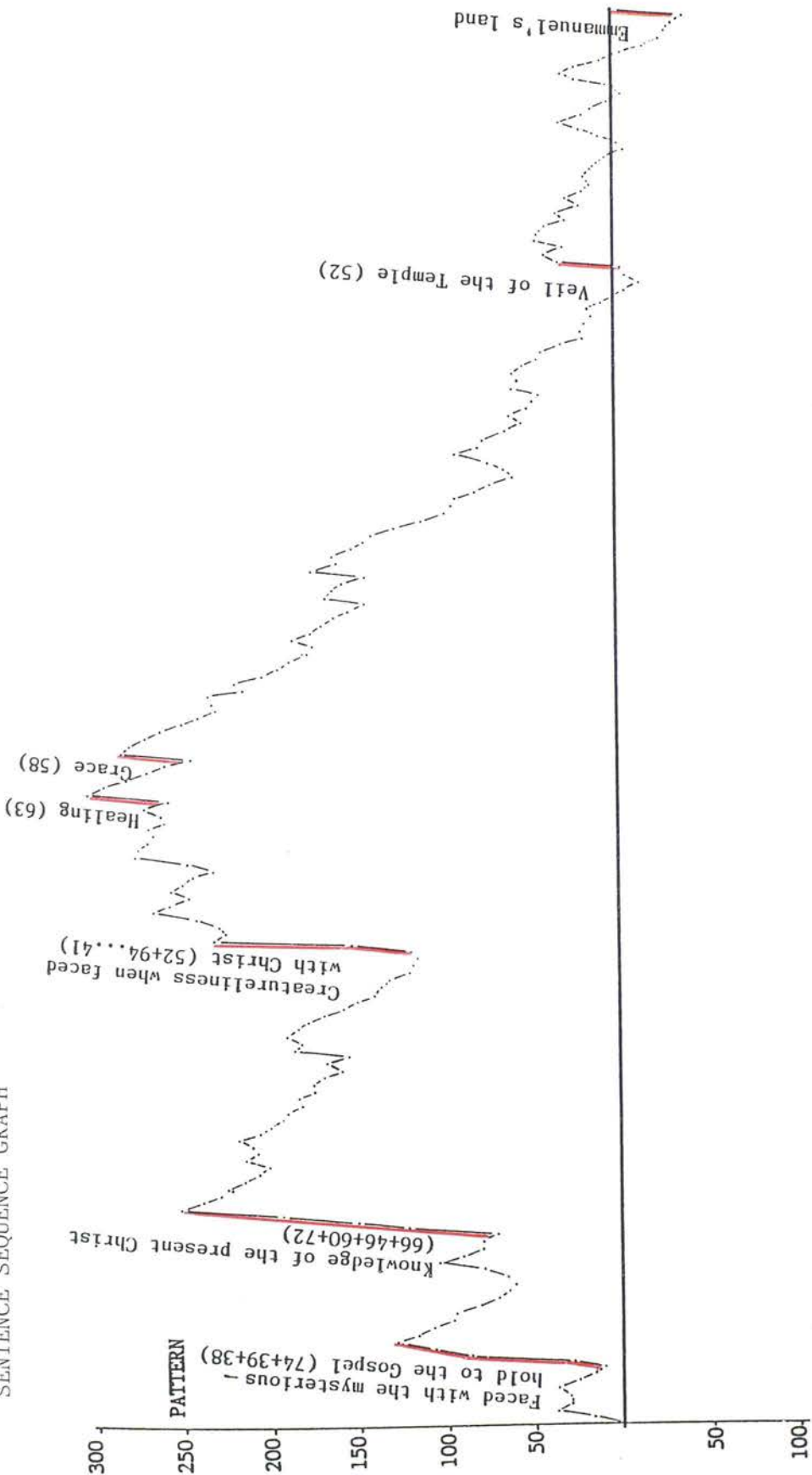
THE NUMINOUS - RELATED TO LONG SENTENCES

AUTHOR: JAMES S. STEWART

TITLE: "VANGUARD AND REARGUARD"

A.S.L. 17.47 WORDS: 2883 SENTENCES: 165

SENTENCE SEQUENCE GRAPH



THE NUMINOUS - RELATED TO LONG SENTENCES

AUTHOR: JAMES S. STEWART

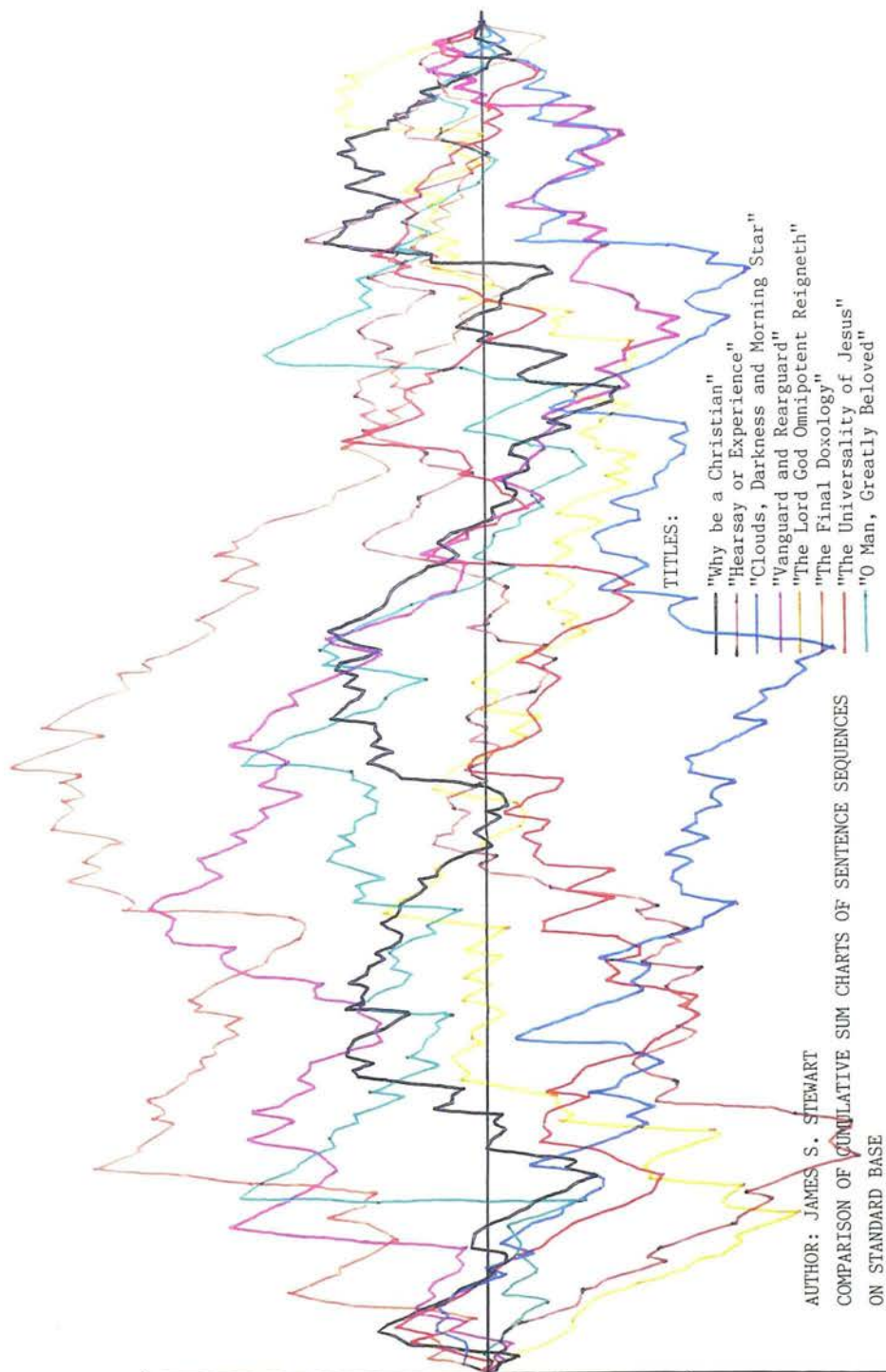
TITLE: "THE FINAL DOXOLOGY"

A.S.L. 16.83 WORDS: 3400 SENTENCES: 202

sentences. Examination of the graphs shows that there are very few long sentences which are not noted as having numinous content, and the passages with short sentences tend to contain more mundane material.

This motif in Stewart's writing may be related to the non-rational component which in Chapter One (pp. 23ff.) was found in monumentality, in the sublime and in the numinous, and was traced through architecture, art, music and literature. In this case the motif itself is readily recognisable but the size of each very long sentence is quite unpredictable. It may vary in length from 40 words to over 220 words. As happens so often where monumentality is involved, the unusual dimension is apparent but there is no obvious reason for its extent. A monumental entrance door may be anything from eight feet to fifty feet in height: the choice is a matter of mood rather than of reason. In such instances the features of the motif are of more significance than its size.

A collage of sentence sequence graphs is shown on page 76.



## 3.2 GEORGE K. BARR

While it would have been preferable to use material by other hands in these studies, I have included twenty of my own sermons because I know something of the circumstances under which they were written. These twenty were taken mostly at random from sermons preached over a period of twenty five years, but a group of five were deliberately included as they represent the reworking of material several times over. Conducting Quinquennial Visitations was almost an annual event in my ministry and on such occasions much of the material contained in these five sermons was reworked to suit the particular situation. Graphs of these five are shown on page 78 and it will be seen that there is no notable degree of contrast: in most cases the plot tends to lie close to the base line. The distribution curves are identified on page 79. The original sermon (no. 1) clearly had little contrast and the second and third even less. The last version (no. 5) has completely lost the skew which is typical of sentence distributions and is virtually symmetrical. The location of the distributions of these reworked sermons relative to those of other normal sermons might be compared with the location of Stewart's lectures (see page 70) relative to his preaching material. It may be that Stewart worked over his lectures rather more than he did his sermons. This tendency to lose contrast is what might be expected when a scissors and paste technique is used to assemble a sermon, and material conceived at different scale levels is conflated.

A similar result may be expected when the process of writing is interrupted. In a busy parish with a large population, it was unusual to complete the writing of a sermon without being interrupted by the telephone or door bell. The contrast in a piece of writing depends upon variations in ASL from section to section and it is not an easy matter to resume writing at exactly the same level after an interruption. Unfortunately I kept no record of interruptions, but it does seem likely that those graphs which lie close to the base line reflect, in some cases at least, interruptions which did not allow major contrasts to develop.

There is no clear overall pattern in the sentence sequence graphs shown on pages 80f. It is necessary to refer to the text and to note the sectional divisions. Six sermons have been selected and the sectional

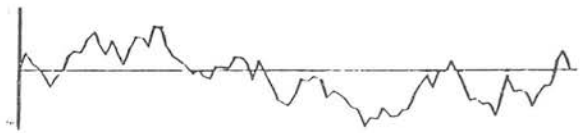


**REWORKED MATERIAL**  
**SERMON: "GOD'S TIME"**

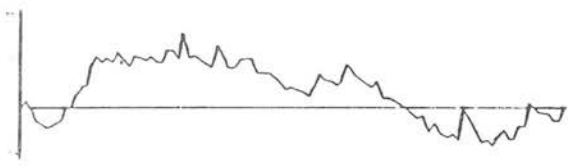
SENTENCE SEQUENCE GRAPHS



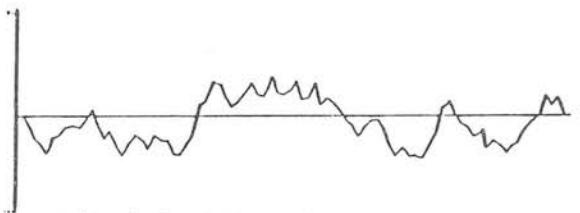
18/2/68 ASL: 17.24 1362 words



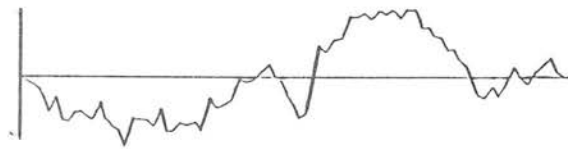
28/10/79 ASL: 21.63 1925 words



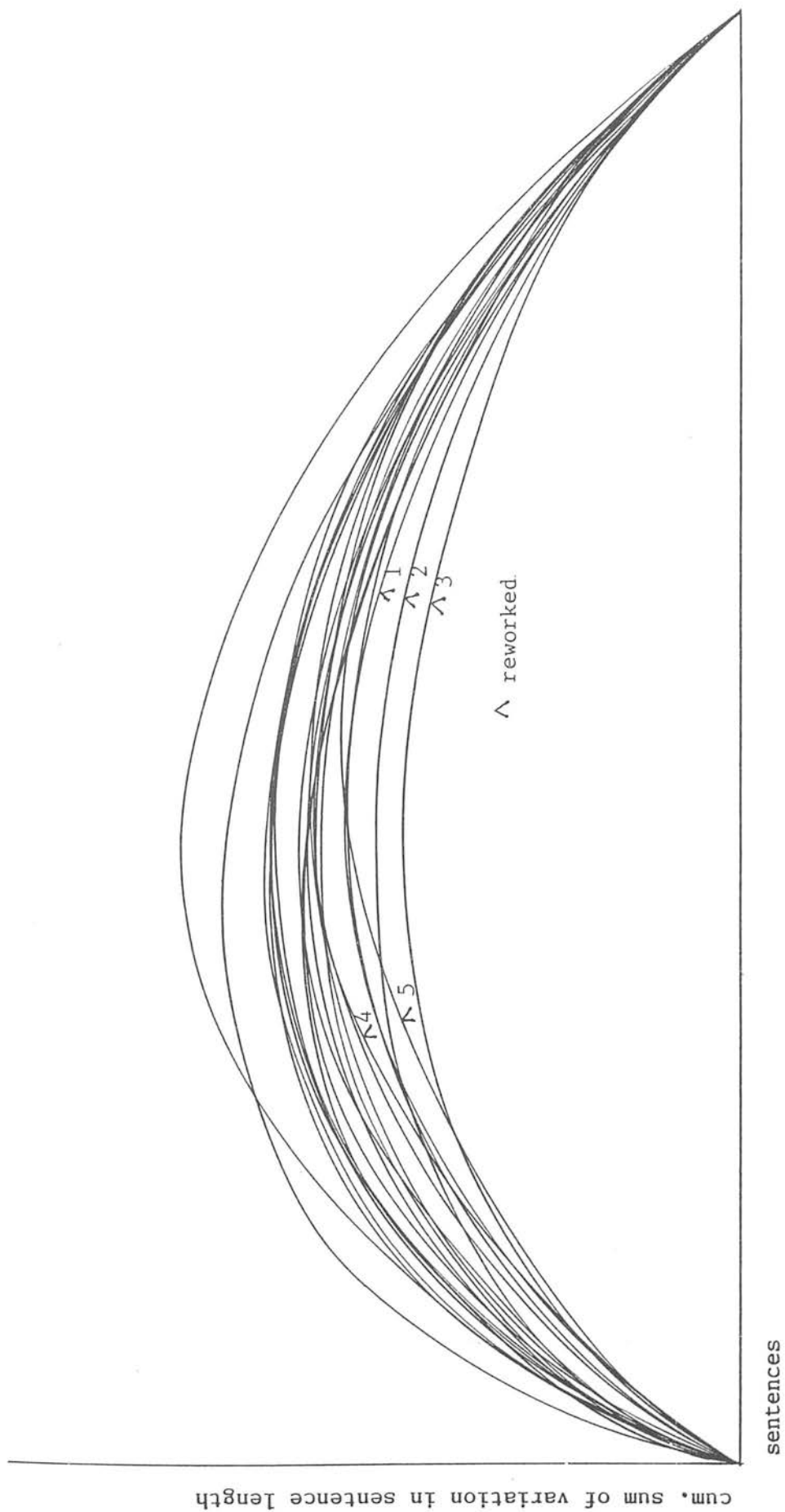
15/12/68 ASL: 21.43 1693 words



28/10/84 ASL: 24.17 2079 words



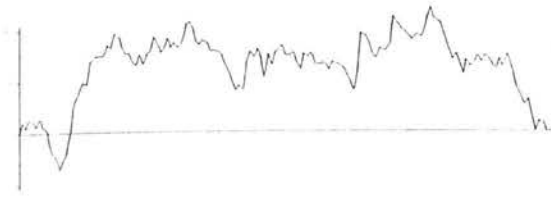
25/9/77 ASL: 22.82 2236 words



# SENTENCE DISTRIBUTION CURVES

AUTHOR: GEORGE K. BARR - 20 SERMONS

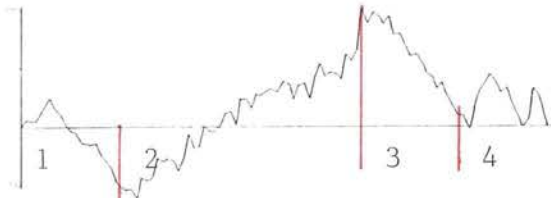
SENTENCE SEQUENCE GRAPHS



GEORGE K. BARR  
"HOW TO PLAY YOUR BEST ALL THE TIME"  
ASL: 14.28 2114W 148S



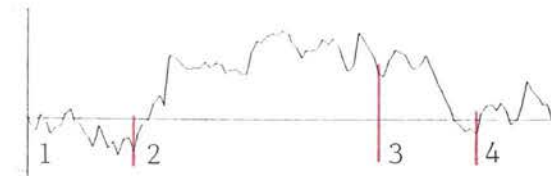
GEORGE K. BARR  
"GOD'S TIME" - I.  
ASL: 17.24 1362W 79S



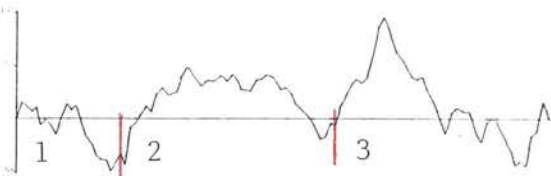
GEORGE K. BARR  
"FREELY YOU HAVE RECEIVED"  
ASL: 17.97 1815W 101S



GEORGE K. BARR  
"YOU MUST BE BORN AGAIN"  
ASL: 19.00 2129W 112S



GEORGE K. BARR  
"KNOWING AND BEING KNOWN"  
ASL: 19.08 1984W 104S



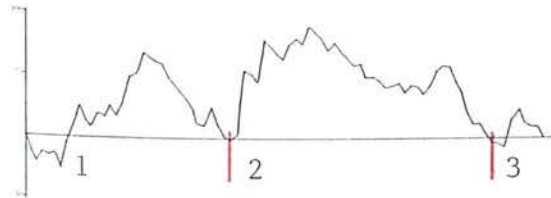
GEORGE K. BARR  
"THE PROPHECIC VOICE"  
ASL: 19.09 2024W 106S



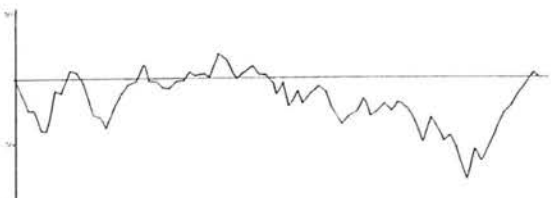
GEORGE K. BARR  
"BY WHAT AUTHORITY"  
ASL: 19.49 1910W 98S



GEORGE K. BARR  
"ASHAMED - YET UNASHAMED"  
ASL: 20.15 1793W 89S

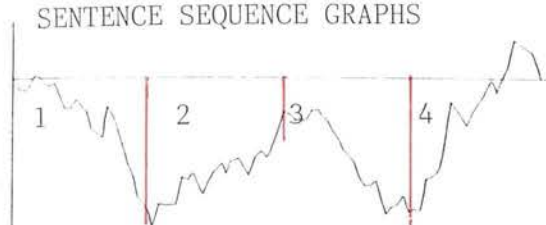


GEORGE K. BARR  
"SUNRISE"  
ASL: 20.18 1675W 83S



GEORGE K. BARR  
"THE JOY OF CHRIST"  
ASL: 20.35 1608W 79S

# SENTENCE SEQUENCE GRAPHS



GEORGE K. BARR  
"TO THE UNKNOWN GOD"  
ASL: 21.19 2035W 96S



GEORGE K. BARR  
"LOVE INCARNATE"  
ASL: 21.28 1468W 69S



GEORGE K. BARR  
"GOD'S TIME" - 2  
ASL: 21.43 1693W 79S



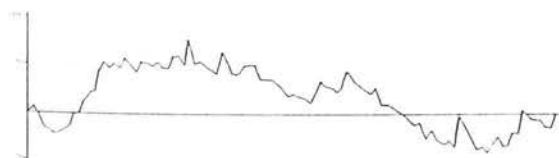
GEORGE K. BARR  
"THE MINISTRY OF SILENCE"  
ASL: 21.53 2024W 94S



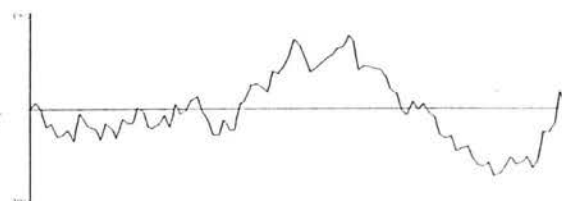
GEORGE K. BARR  
"GOD'S TIME" - 4  
ASL: 21.63 1925W 89S



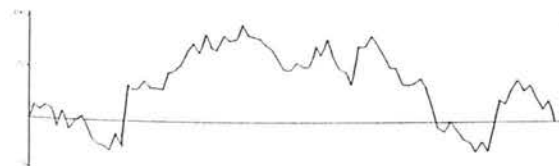
GEORGE K. BARR  
"DOWN TO EARTH"  
ASL: 22.35 1810W 81S



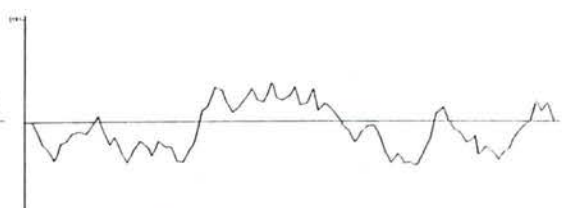
GEORGE K. BARR  
"GOD'S TIME" - 3  
ASL: 22.82 2236W 98S



GEORGE K. BARR  
"OFF THE PEG"  
ASL: 23.38 2315W 99S



GEORGE K. BARR  
"THE ELDERSHIP' ACCORDING TO PETER"  
ASL: 23.98 2086W 87S



GEORGE K. BARR  
"GOD'S TIME" - 5  
ASL: 24.17 2079W 86S

divisions are shown marked in red on pages 80f. In each case changes in the underlying ASL occur at the sectional divisions. Where the ASL of the section is higher than that of the whole sermon, the graph rises; where it is lower, the graph falls. It is notable that sections which contain challenging material tend to have a high ASL. The six sample sermons are as follows and reference should be made to the graphs on pages 80f:

*"To the Unknown God"*

Section 1 - introduction	ASL	15.96	words.
Section 2 - Present day gods (attacking style)	ASL	25.96	words.
Section 3 - Steps in Paul's argument	ASL	17.59	words.
Section 4 - Call for response (challenging)	ASL	26.65	words.

*"Down to Earth"*

Section 1 - Idealised Christmas	ASL	19.81	words.
Section 2 - The Actuality of Jesus' Coming	ASL	31.12	words.
Section 3 - Postscript on Christmas Communion	ASL	15.40	words.

(In this case the challenge was in section 2; section 3 provided a quiet reflective note before Communion.)

*"Freely You Have Received"*

Section 1 - introduction	ASL	15.53	words.
Section 2 - Receiving	ASL	20.90	words.
Section 3 - Possessing	ASL	12.76	words.
Section 4 - Postscript	ASL	17.44	words.

*"Knowing and Being Known"*

Section 1 - introduction	ASL	18.24	words.
Section 2 - Knowing others	ASL	20.65	words.
Section 3 - Knowing ourselves	ASL	15.63	words.
Section 4 - Communion postscript	ASL	19.56	words.

(It may be noted that the two sermons above have similar features though the small detail varies. Each begins with an introductory section with a lower ASL than that of the whole sermon followed by a challenging section with a higher ASL. There follows a more reflective section with a lower ASL and each ends with a post script which on the graphs has the same twin humped form. The proportions of the various sections are similar. The

sermons are separated in time by a little over two years.)

*"The Prophetic Voice"*

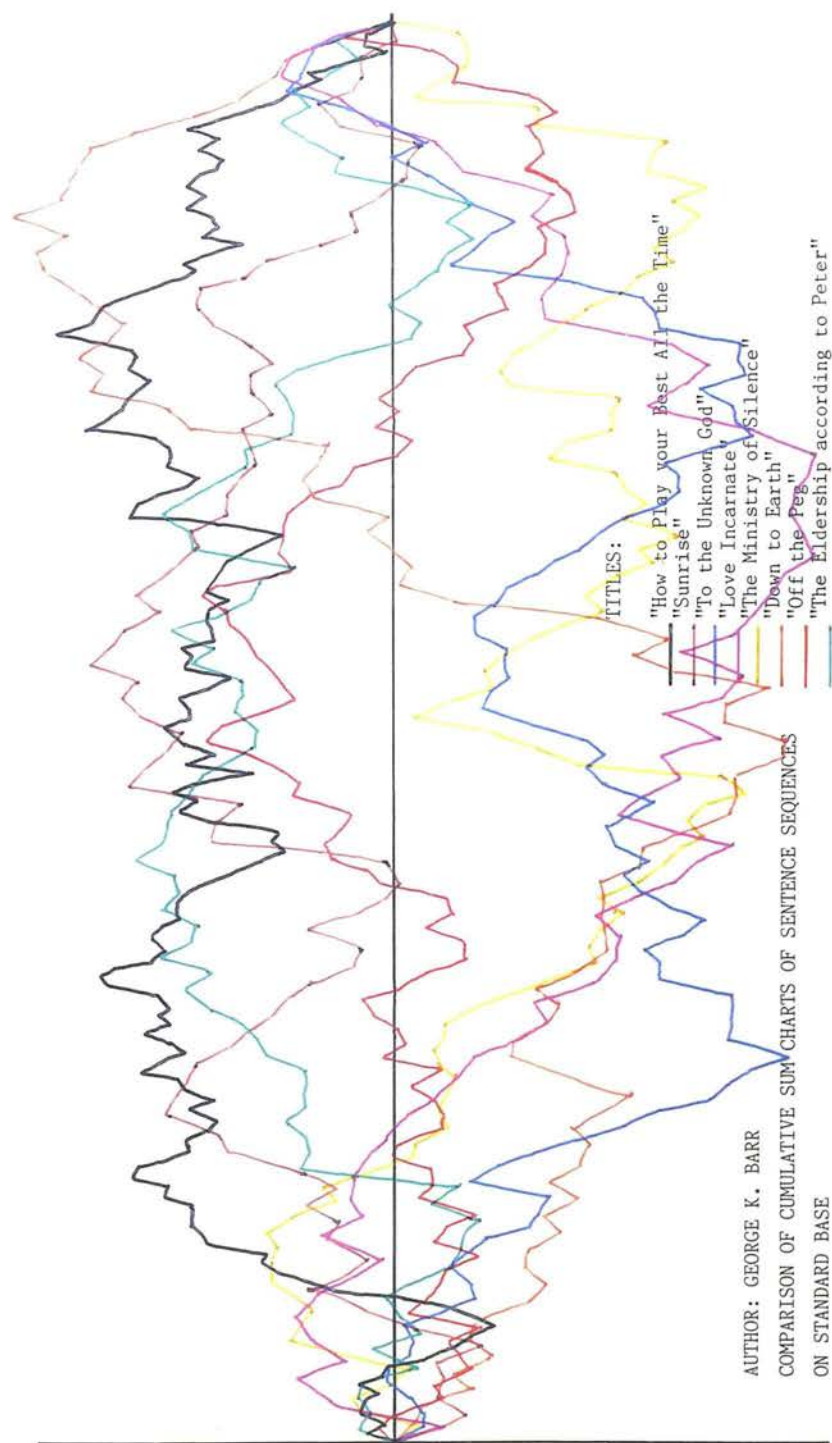
Section 1 - introduction	ASL	17.09	words.
Section 2 - Old Testament prophecy and Amos	ASL	20.00	words.
Section 3 - Amos's attack	ASL	19.24	words.

*"Sunrise"*

Section 1 - "Sunset"	ASL	20.12	words.
Section 2 - The Cross and the Rising	ASL	20.12	words.
Section 3 - Postscript: Joy and Sorrow	ASL	20.67	words.

This last example has characteristics which may have some significance. It falls into three sections all of which have virtually the same ASL. The first is a description which is complete in itself. The second consists of Biblical material which is complete in itself. The third is a postscript reflecting on the theme. The form of this sermon is therefore an assemblage of three independent pieces rather than one composition. Compare essay on page 149.

A collage of sentence sequence graphs is shown on page 84.





### 3.3 O. HENRY

The short stories of O. Henry [3] show great variety in contrast and in sentence structure. This is reflected in the sequence graphs on pages 86f., but these do not provide any obvious overall pattern. The text may be analysed in the following terms:

- a. Descriptive storytelling, which has a higher than average ASL.
- b. Passages which are predominantly conversational, with a low ASL.
- c. Dramatic passages with lively action, also with a low ASL.
- d. A twist in the tale - where an unexpected ending is reflected in the graph. Examples of this feature are identified on the graphs with the letter T - six examples are so labelled.

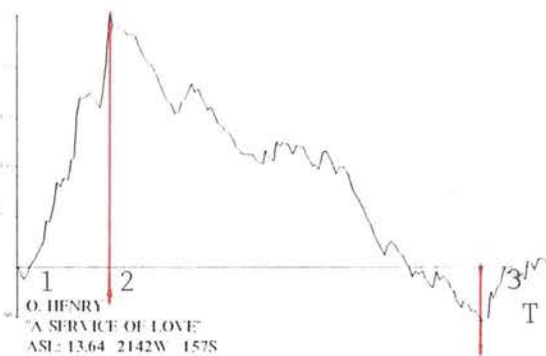
The conversation in these stories may have different characteristics from those found in genuine tape recorded conversation. It is an imaginative construction created by the author and put into the mouths of the characters in the story. It may reflect something of the author himself, combined with characteristics observed in the speech of other people. Occasionally such conversation stands on its own: more often it is embedded within a context. Nevertheless, it has a marked influence on average sentence length and on the shape of sentence sequences. (Differences between the characteristics of written and spoken language are explored by M.A.K. Halliday in *Spoken and Written Language* [30]). In general, passages of descriptive storytelling are marked by a rise in the graph, conversation and passages with lively action by a fall in the graph. A mixture of conversation and description provides a graph which fluctuates about the average. These features are most clearly seen in the stories which provide the most contrast in terms of sentence length. A few examples will suffice and reference should be made to the graphs on pages 86f.

"A Service of Love" [3, p. 45]	
Section 1 - description	ASL 22.75 words.
Section 2 - conversation and lively action.	ASL 10.82 words.
Section 3 - a twist in the tale.	ASL 16.30 words.

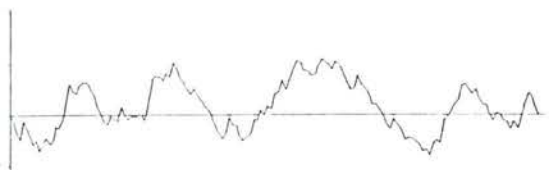
# SENTENCE SEQUENCE GRAPHS



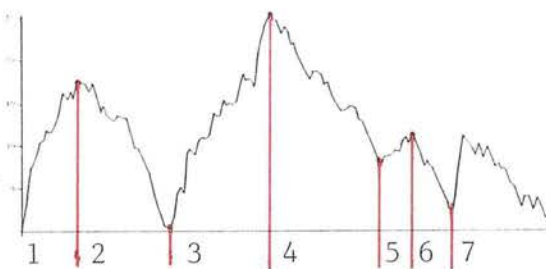
O. HENRY  
"MAMMON AND THE ARCHER"  
ASL: 12.65 2341W 185S



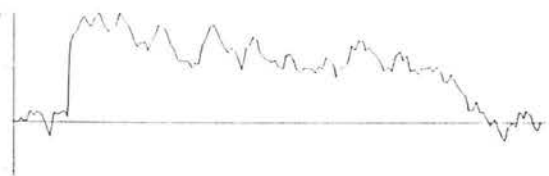
O. HENRY  
"A SERVICE OF LOVE"  
ASL: 13.64 2142W 157S



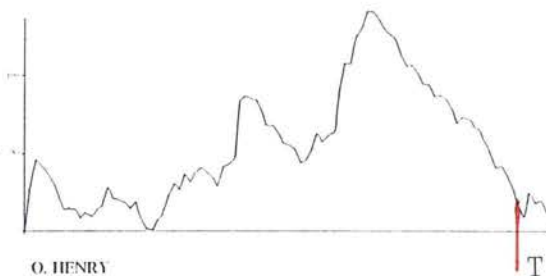
O. HENRY  
"THE GIFT OF THE MAGI"  
ASL: 13.79 2083W 151S



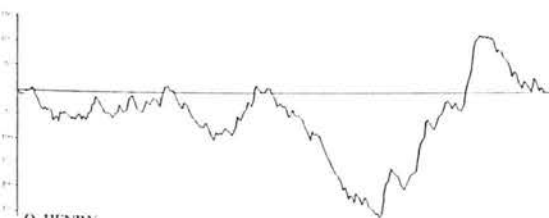
O. HENRY  
"THE COMING OUT OF MAGGIE"  
ASL: 13.94 2509W 180S



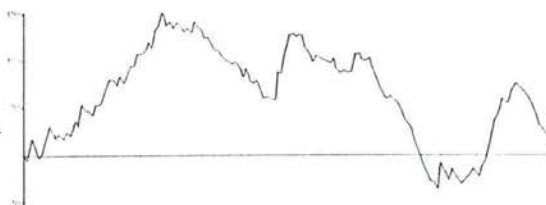
O. HENRY  
"BETWEEN ROUNDS"  
ASL: 14.00 2058W 147S



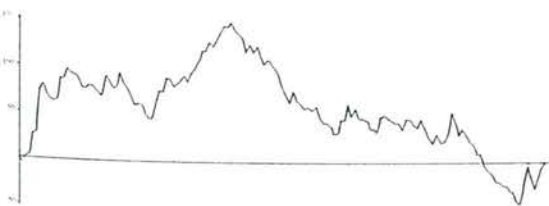
O. HENRY  
"THE ROMANCE OF A BUSY BROKER"  
ASL: 14.33 1376W 96S



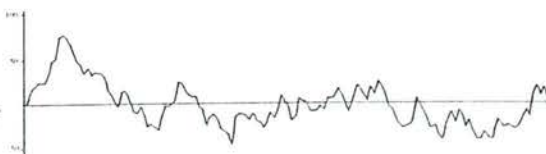
O. HENRY  
"HEARTS AND CROSSES"  
ASL: 14.57 4356W 209S



O. HENRY  
"THE COP AND THE ANTHEM"  
ASL: 15.03 2270W 151S

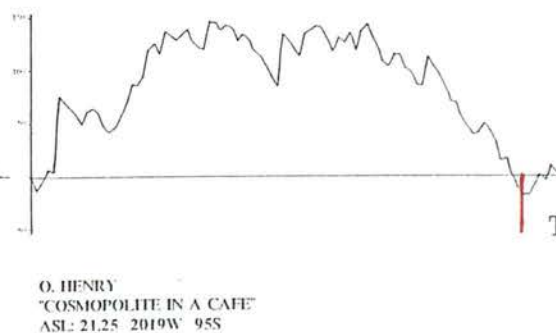
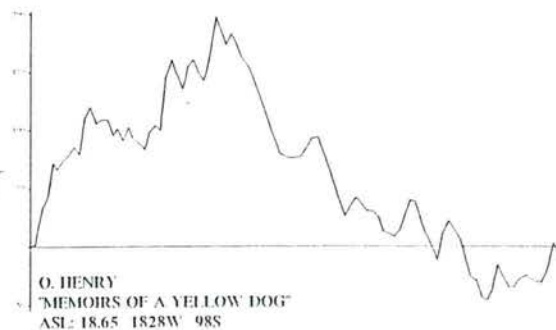
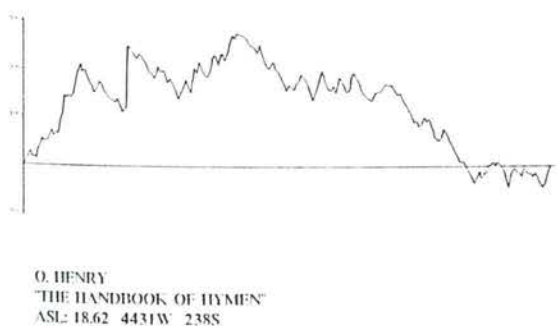
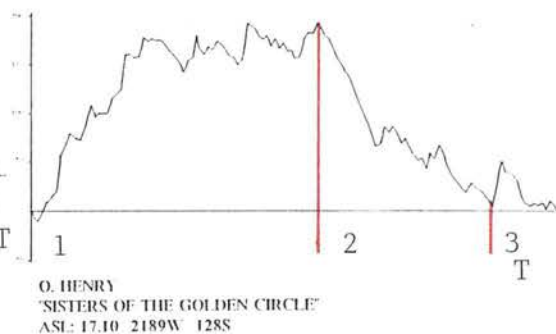
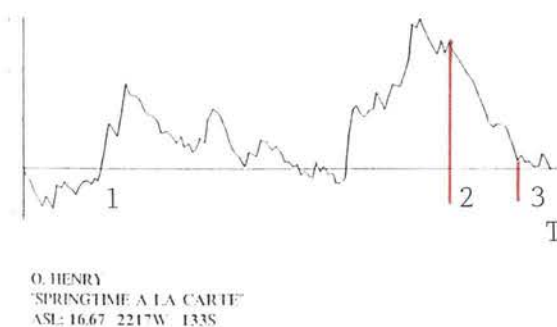
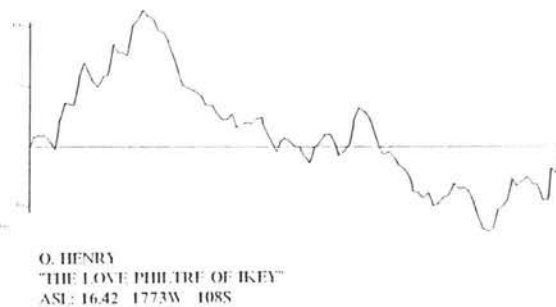
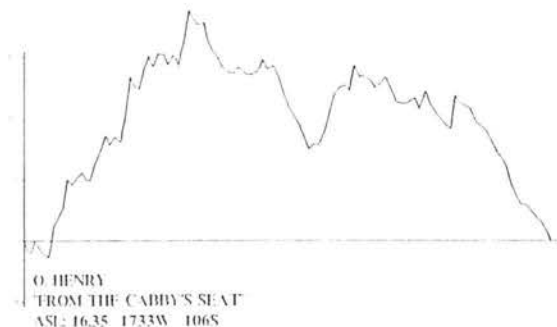
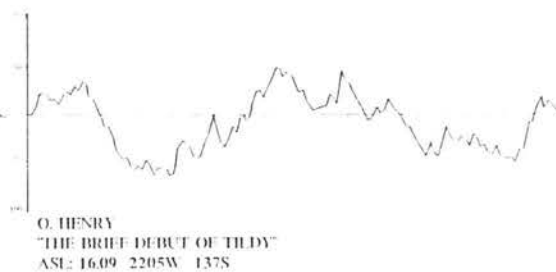
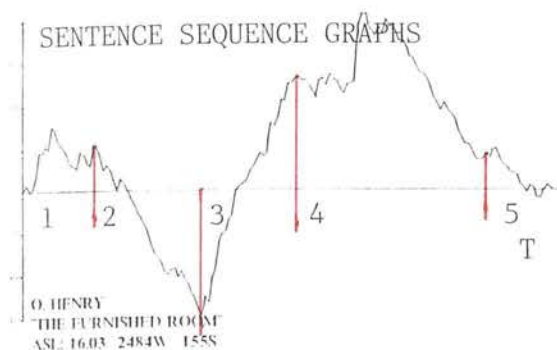


O. HENRY  
"THE SKYLIGHT ROOM"  
ASL: 15.71 2294W 146S



O. HENRY  
"AN UNFINISHED STORY"  
ASL: 15.81 2372W 150S

# SENTENCE SEQUENCE GRAPHS



*"The Coming Out of Maggie"* [3, p. 53]

Section 1 - description	ASL	22.65	words.
Section 2 - conversation.	ASL	9.32	words.
Section 3 - descriptive storytelling.	ASL	21.90	words.
Section 4 - largely conversation.	ASL	9.59	words.
Section 5 - description.	ASL	17.80	words.
Section 6 - conversation.	ASL	7.64	words.
Section 7 - description, lively action and conversation providing a twist in the tale.	ASL	13.40	words.

*"The Furnished Room"* [3, p. 127]

Section 1 - description	ASL	18.50	words.
Section 2 - conversation	ASL	9.69	words.
Section 3 - descriptive	ASL	26.92	words.
Section 4 - lively action with one long sentence describing the character's thoughts.	ASL	14.61	words.
Section 5 - a twist in the tale.	ASL	13.74	words.

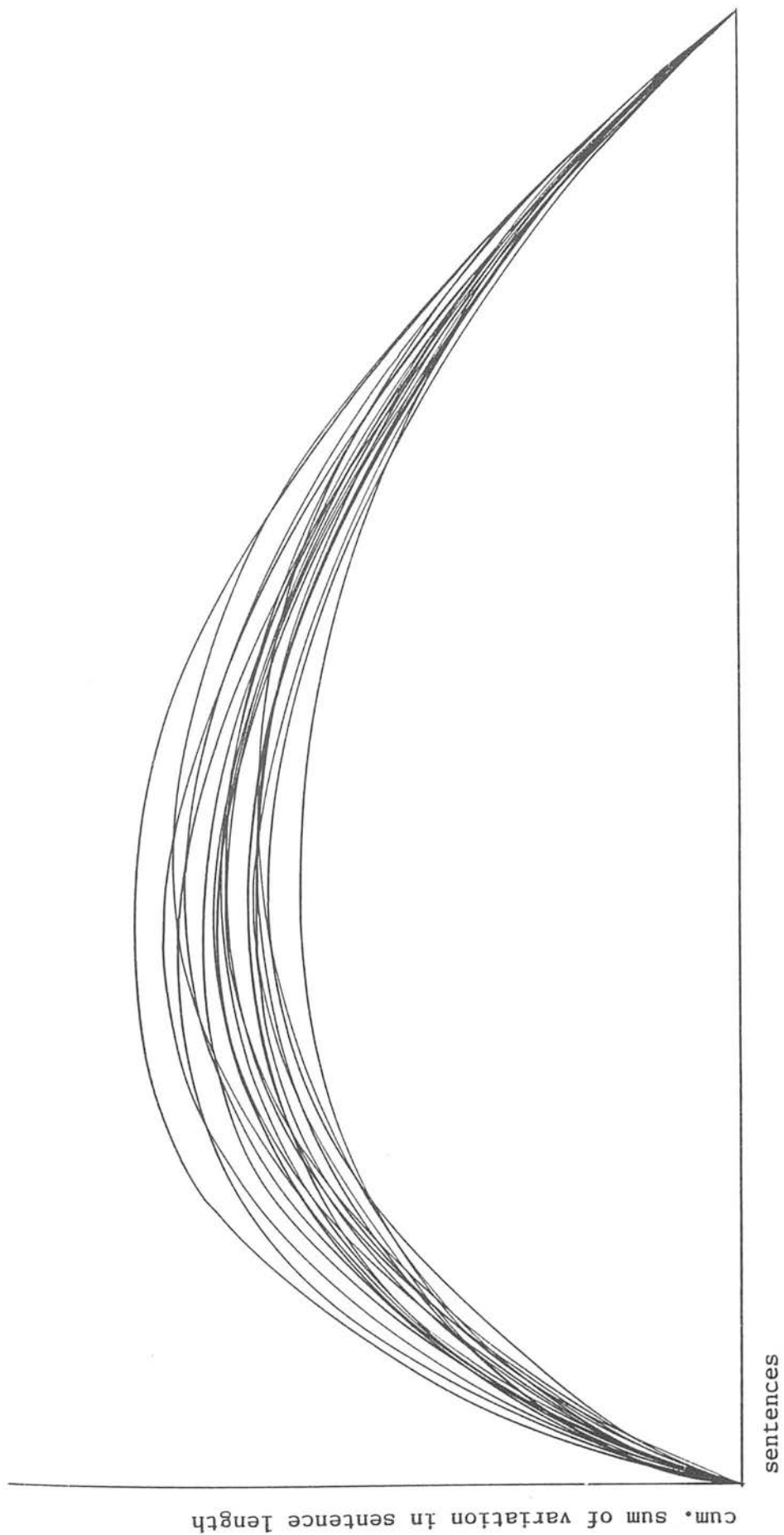
*"Springtime a la Carte"* [3, p. 91]

Section 1 - storytelling, no conversation	ASL	17.70	words.
Section 2 - largely conversational	ASL	10.61	words.
Section 3 - the twist in the tale	ASL	15.25	words.

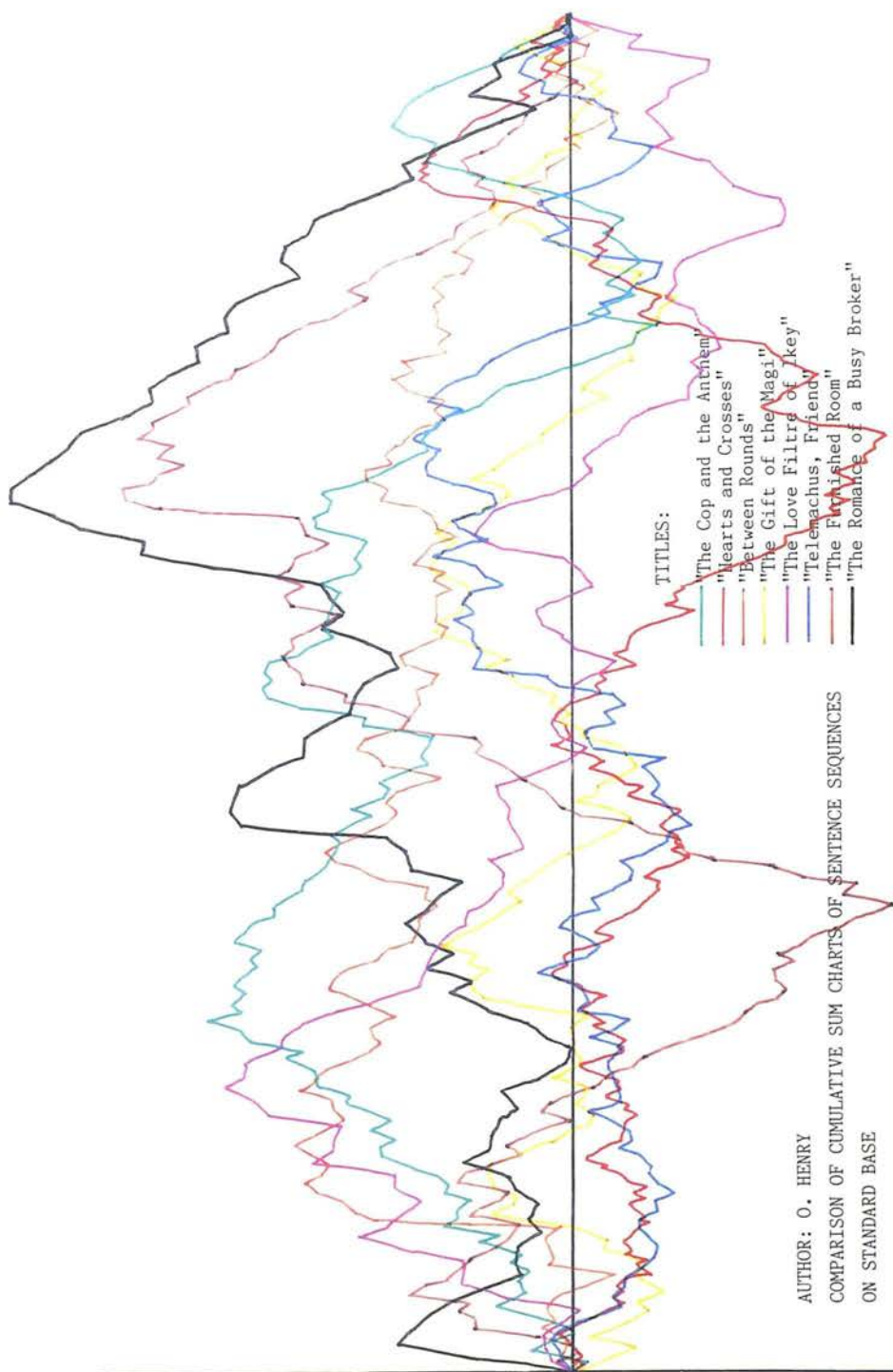
*"Sisters of the Golden Circle"* [3, p. 114]

Section 1 - descriptive storytelling	ASL	20.10	words.
Section 2 - conversation	ASL	12.47	words.
Section 3 - the twist in the tale	ASL	16.82	words.

The ASL of descriptive passages ranges from 17.70 to 26.92 words. That of conversation and passages with lively action ranges from 7.64 to 12.47 words. These form two clear and distinct bands. Between them are passages which combine storytelling and conversation in varying degrees, and this is reflected in the ASL of such passages. It can be seen that the sentence sequence graphs take their form from the assembly of sections of different kinds, one might say of different genres, each with an appropriate ASL. (See section 4.4.6 on Homogeneity). The sentence distribution curves are shown on page 89 and a collage of eight sentence sequence graphs on page 90.



SENTENCE DISTRIBUTION CURVES  
AUTHOR: O. HENRY - 20 SHORT STORIES



### 3.4 BARBARA ERSKINE

Sentence sequence patterns in Barbara Erskine's short stories display characteristics which are similar to those found in the work of O. Henry. They are largely determined by the contrast between conversation and storytelling. They may be considered under three groupings. The first pair of samples (on page 92) are those with the lowest ASL - "*Visitors*" [2, p. 15] and "*All this Childish Nonsense*" [2, p. 325]. These are written in a very staccato style, the prose borrowing from the rhythms of the conversation. This results in very low ASLs - 7.94 and 9.33 words respectively. While the first sample appears to have some contrast, this is deceptive as the ASL is very low. The variations in these two graphs represent a normal variation of pace in telling the story and are not related markedly to particular features.

The stories in the second group have characteristics similar to those found in O. Henry's works, and may be divided into sections of descriptive storytelling and conversation. These show similar variations in ASL. The sections are marked in red on the graphs on page 92.

*"Trade Reunions"* [2, p. 83]

Section 1 - description	ASL	14.97	words.
Section 2 - mixed conversation and storytelling	ASL	8.76	words.
Section 3 - mostly description	ASL	16.32	words.
Section 4 - conversation	ASL	6.36	words.

*"The Valentine's Day Plot"* [2, p. 49]

Section 1 - description	ASL	14.32	words.
Section 2 - conversation	ASL	5.87	words.
Section 3 - description	ASL	12.44	words.
Section 4 - conversation	ASL	9.15	words.

*"Cabbage a la Carte"* [2, p. 21]

Section 1 - description	ASL	14.91	words.
Section 2 - conversation and description mixed	ASL	9.30	words.
Section 3 - description	ASL	16.33	words.
Section 4 - conversation	ASL	9.90	words.
Section 5 - conversation and description mixed	ASL	11.09	words.



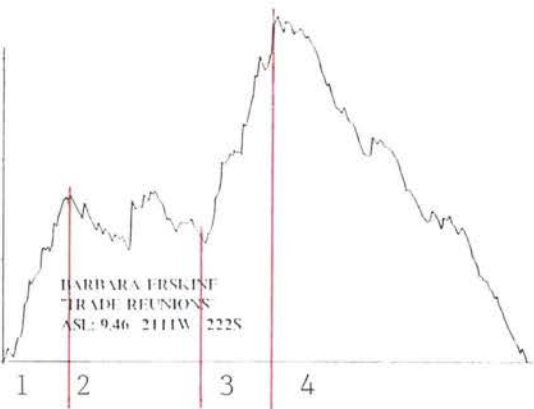
SENTENCE SEQUENCE GRAPHS



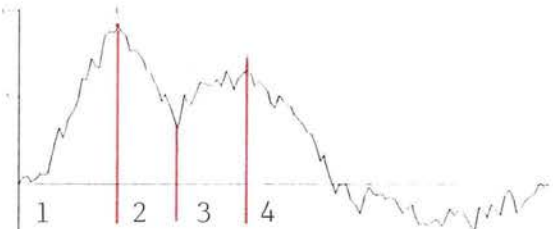
BARBARA ERSKINE  
"VISITORS"  
ASL: 7.94 2574W 324S



BARBARA ERSKINE  
"ALL THIS CHIDISH NONSENSE"  
ASL: 9.33 2546W 273S



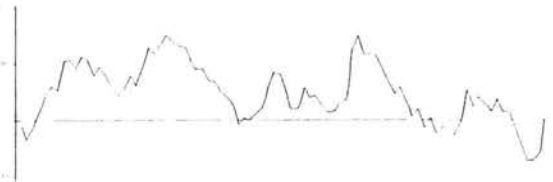
BARBARA ERSKINE  
"TRADE REUNIONS"  
ASL: 9.46 2111W 222S



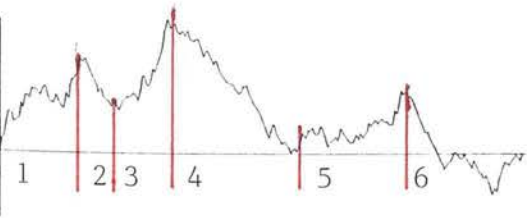
BARBARA ERSKINE  
"THE VALENTINE'S DAY PLOT"  
ASL: 10.01 1261W 125S



BARBARA ERSKINE  
"CABBAGE A LA CARTE"  
ASL: 11.7 2995W 256S



BARBARA ERSKINE  
"THE TOUCH OF GOLD"  
ASL: 12.83 1129W 88S



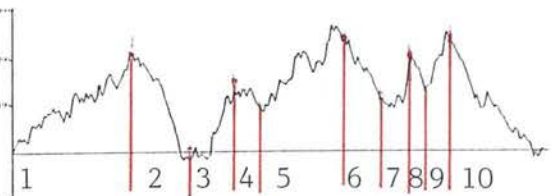
BARBARA ERSKINE  
"A WINDOW ON THE WORLD"  
ASL: 13.5 3307W 245S



BARBARA ERSKINE  
"METAMORPHOSIS"  
ASL: 14.48 3228W 223S



BARBARA ERSKINE  
"TELETYPE EXPRESS"  
ASL: 15.25 2531W 166S



BARBARA ERSKINE  
"THERE WAS A TIME WHEN..."  
ASL: 18.5 4496W 243S

*"A Window on the World"* [2, p. 340]

Section 1 - description	ASL	16.68	words.
Section 2 - conversation	ASL	10.59	words.
Section 3 - description	ASL	17.89	words.
Section 4 - conversation	ASL	10.36	words.
Section 5 - description	ASL	14.96	words.
Section 6 - conversation and description mixed	ASL	11.94	words.

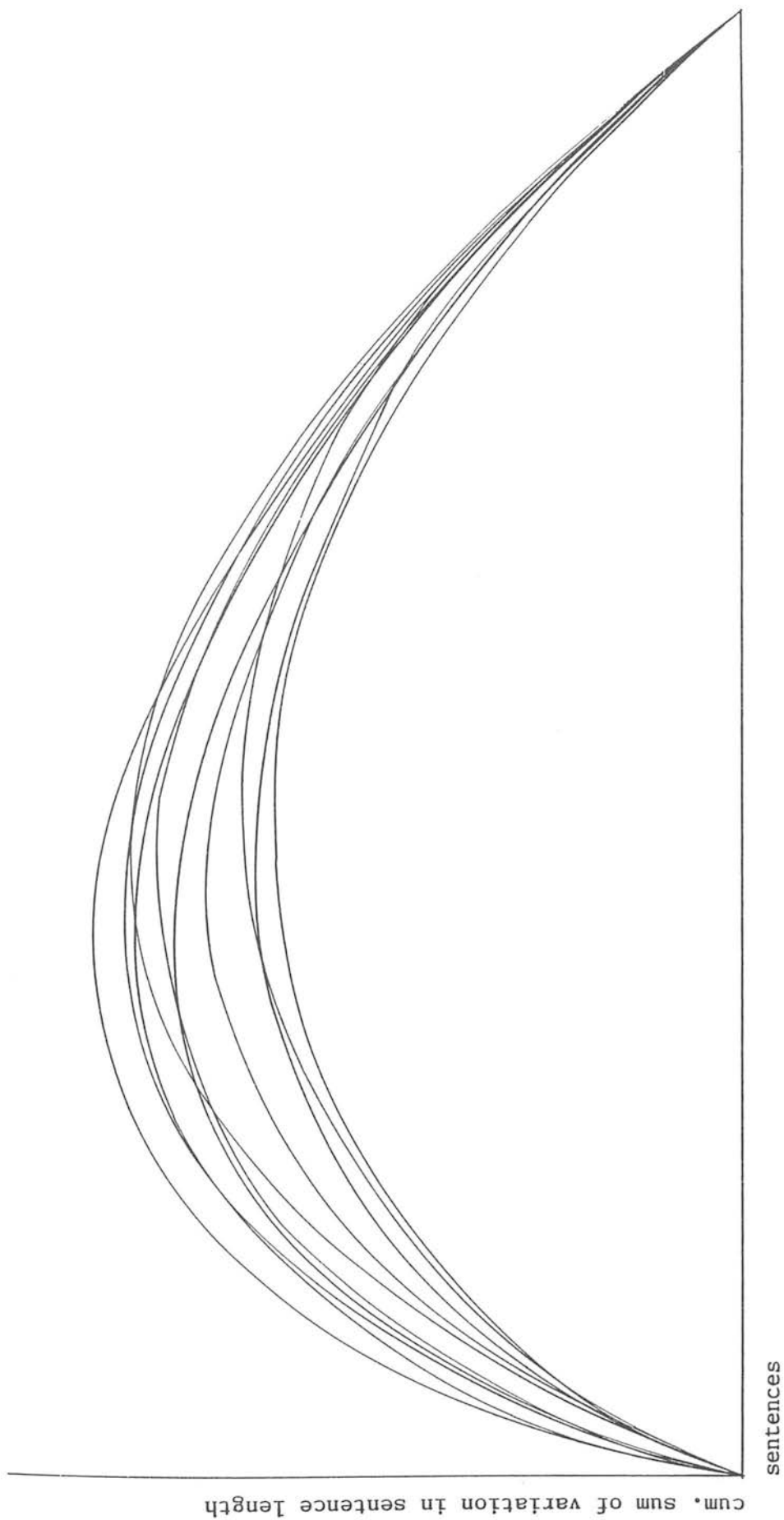
*"There Was a Time When"* [2, p. 52] - This piece falls neatly into ten sections, conversation alternating with description.

The third group consists of *"The Touch of Gold"* [2, p. 120], *"Feline Express"* [2, p. 35] and *"Metamorphosis"* [2, p. 52]. The first two have no conversation, while in the second conversation and description are very mixed. The graphs simply reflect normal changes of pace in storytelling.

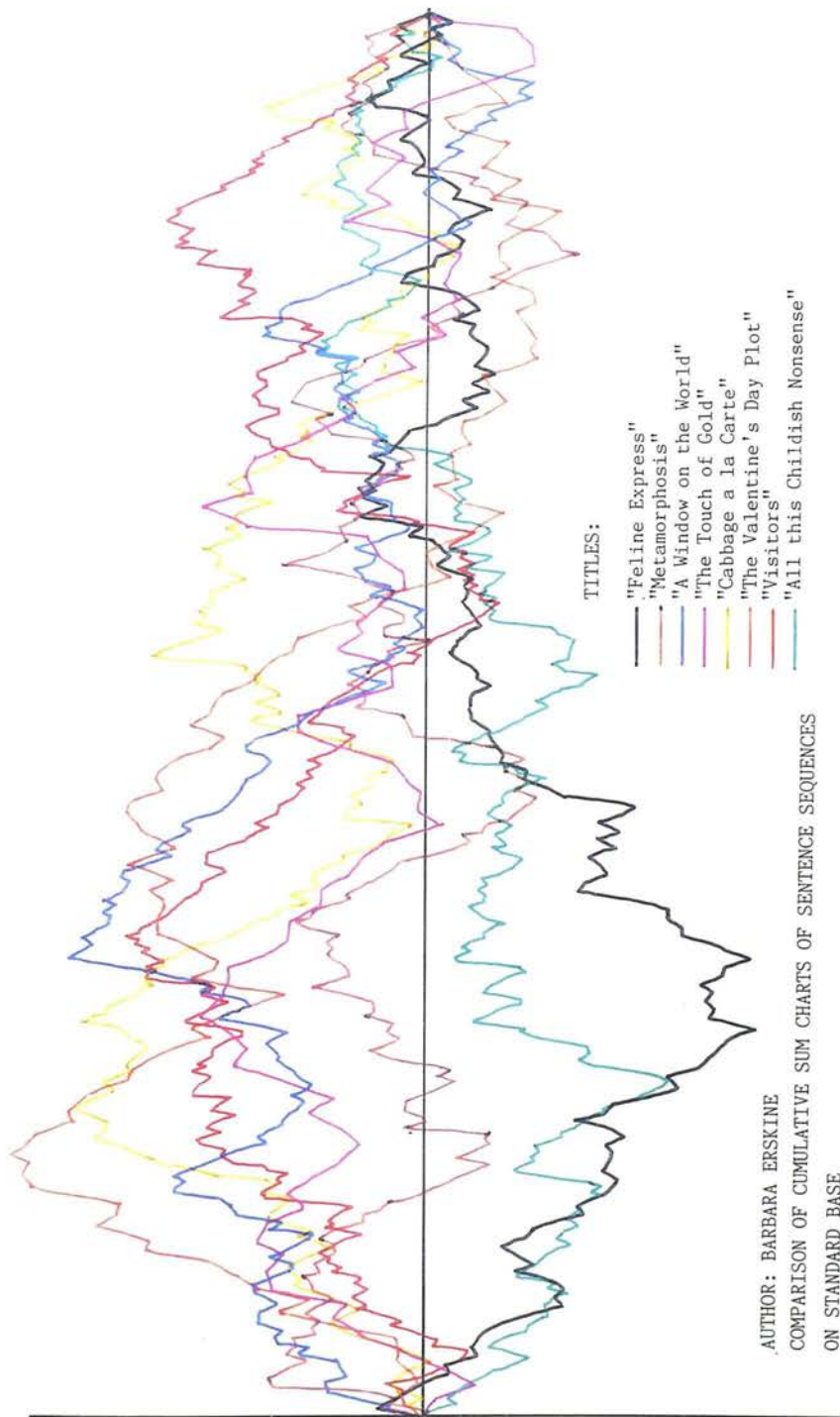
In Barbara Erskine's short stories, the ASLs of the conversational passages run from about 6 to 11 words; those of descriptive passages from about 12 to 25 words. Again they form two clear and distinct bands. Between them lie passages combining conversation and description, with appropriate ASLs. Where the two modes are mixed the graph takes its form from the changes in ASL from section to section. Where the text is homogeneous, the graph takes its form from the normal changes of pace found in storytelling.

These examples from my own sermons and from the short stories of O. Henry and Barbara Erskine demonstrate how changes in genre within a piece may affect sentence length. "Conversation" in this context is not genuine conversation, but is the writer's construction. Nevertheless in the hands of these writers it has different characteristics from their descriptive passages. Change of pace in story telling, changes from description to challenge in a sermon, may constitute internal changes of genre which are reflected in changes of scale from section to section.

Distribution curves of Barbara Erskine's works are shown on page 94 and a collage of sentence sequence graphs on page 95.



SENTENCE DISTRIBUTION CURVES  
 AUTHOR: BARBARA ERSKINE - 10 WORKS



### 3.5 JOHN RUSKIN

Ten pieces were selected from the writings of John Ruskin. Five were taken from *The Poetry of Architecture* [6] having a common theme - "*The Cottage*". It was thought that they might produce patterns with similar features. The other five were selected at random. All the samples are between 2,000 and 4,500 words in length.

The graphs (page 97) do not share any obvious overall pattern but the range of ASL is considerably higher than that of any of the twentieth century writers examined. Ruskin makes liberal use of colons and semicolons, and sentences with more than 100 words are often found. Some of these pieces show little variation: others may be divided into sections with widely varying characteristics, as will be seen from the following notes in which the content of long sentences containing over 100 words is also examined. The sections are marked in red on the graphs on page 97.

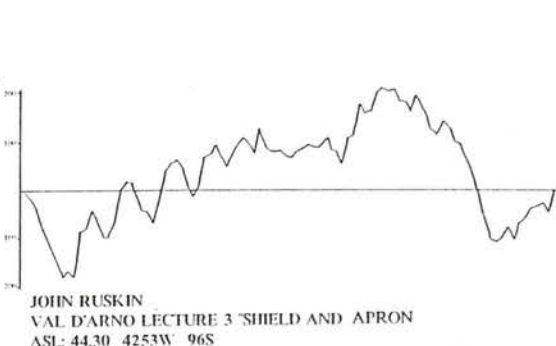
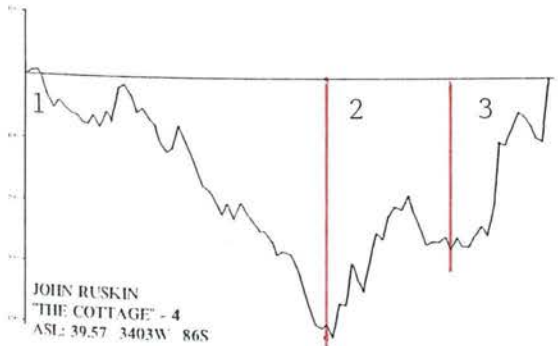
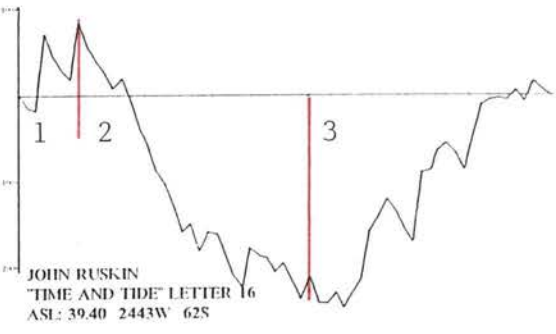
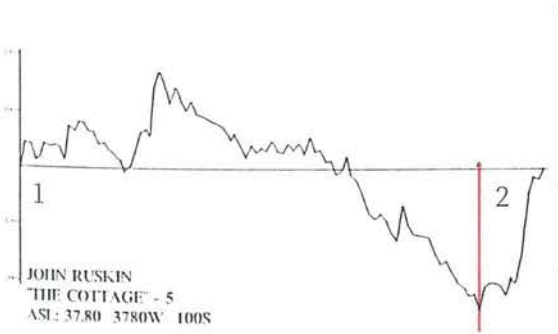
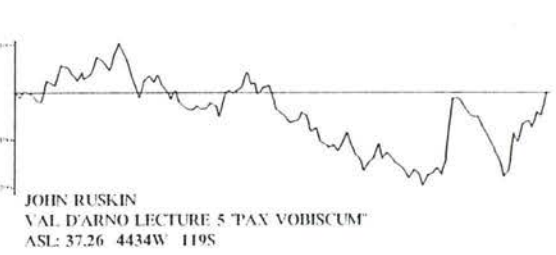
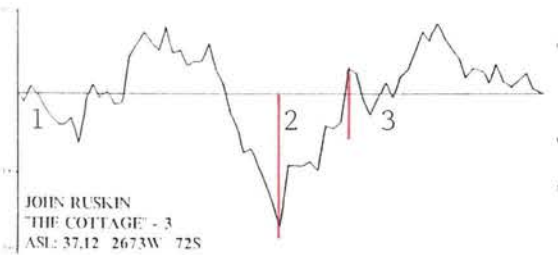
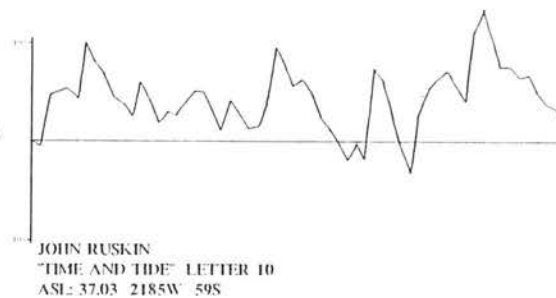
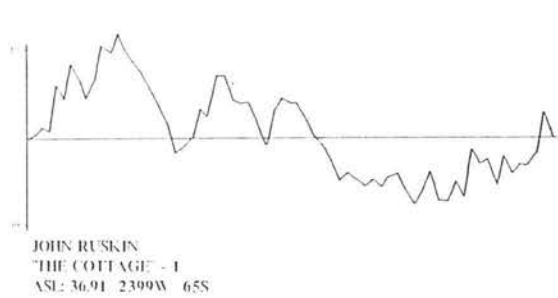
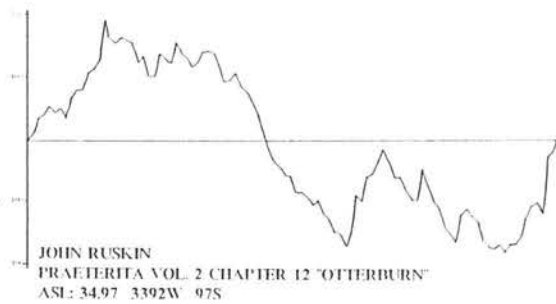
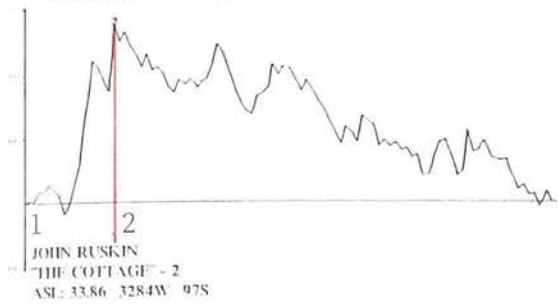
*"The Cottage"* - 1 [6, p. 9] - There is little variation in the material and no sentences of over 100 words. ASL 36.91 words.

*"The Cottage"* - 2 [6, p. 15] - Section 1 is a lyrical passage describing the landscape of Italy - beautiful, melancholic, sublime (Ruskin uses Otto's word) - ending with one long sentence of over 100 words. ASL 49.33 words. Section 2 is description of Italian cottages. ASL 30.33 words.

*"The Cottage"* - 3 [6, p. 25] - Section 1 describes mountain cottages in Switzerland. ASL 32.62 words. Section 2 is a lyrical passage containing two long sentences contrasting the smallness of a cottage with the immensity, the mightiness, the colossal and eternal quality of the Swiss mountain scenery. ASL 59.00 words. Section 3 returns to simple description. ASL 35.96 words.

*"The Cottage"* - 4 [6, p. 33] - Section 1 establishes a general standard of excellence for cottage buildings. ASL 31.66 words. Section 2 contains two long sentences describing in romantic terms how Westmoreland cottages blend in with the landscape which produced the materials of which the cottages were built. ASL 45.75 words. Section 3 includes two long sentences, one contrasting continental and island

SENTENCE SEQUENCE GRAPHS



aspirations, the other being a peroration.

ASL 56.56 words.

*"The Cottage"* - 5 [6, p. 42] - Section 1 describes various designs of chimneys. It contains three long sentences on the humdrum subjects of smoke issuing from a cottage chimney and the poor quality of Spanish and Italian chimneys.

ASL 33.04 words.

Section 2 is concerned with the philosophical aspects of the design of chimneys.

ASL 56.92 words.

Of these five examples, there is a certain lyrical quality in the long sentences of 2, 3 and 4 which might be connected with Otto's sense of "the sublime" (page 32). This quality is lacking in the fifth example.

*Praeterita* Vol. 2. Chapter 12. *"Otterburn"* [5, p. 371] - The graph reflects changes of pace according to the nature of the material. It contains two long sentences, one describing Dr. John Brown's father, the other being a lyrical passage on skies seen by Turner and Ruskin.

ASL 34.97 words.

*Time and Tide*, Letter 10 [7, p. 125] - Shows little variation except for two long sentences describing Satanic power - the ominous rather than the numinous.

ASL 37.03 words.

*Time and Tide*, Letter 16 [7, p. 181] - Section 1 is a brief introductory section regarding spiritual teachers. One long sentence concerns preachers who dare to preach against worldliness.

ASL 51.29 words.

Section 2 changes style to deal rather ironically with the theme "Time is money".

ASL 28.58 words.

Section 3 is a serious discussion on the elements of State Education and contains one long sentence on the integrity of a teacher in thinking and speaking truth.

ASL 49.87 words.

*Val D'Arno*, Lecture 3, *"Shield and Apron"* [8, p. 266] - There are no great changes of pace but there are three long sentences, the first of which refers to a footnote reading "I am sorry to pack my sentences together in this confused way. But I do have much to say; and I cannot always stop to polish or adjust it as I used to do." The content of the first is negligible. The second refers to Art and Scripture and waxes lyrical over craftsmen fulfilling such a divine purpose. The third refers to social power in the 13th



*Val D'Arno*, Lecture 5, "*Pax Vobiscum*" [8, p. 290] - This letter has consistent pace broken only by two sentences of over 100 words, referring to the destruction of palaces etc. in Florence during revolutions in the 13th century.

ASL 37.26 words.

Some of the long sentences noted above do have qualities which might be related to the numinous and the sublime in Otto's terminology. Others deal with comparatively pedestrian subjects and have no hint of such qualities. Here we have to consider two aspects of Ruskin's character. He was an art critic, and in that capacity he was able to criticise the work of architects and artists with impunity. An egotistical streak appears and he takes delight in writing for its own sake, becoming lyrical at times on quite pedestrian subjects. He was not himself a designer. One could admire his encyclopaedic knowledge and his wide interests, but he was not a particularly creative artist. In *Praeterita* (Vol.1, p.102) he says that he had "a violent instinct for architecture; but I never could have built or carved anything, because I was without power of design; and have perhaps done as much in that direction as it was worth doing with so limited faculty." At times Ruskin was carried away with wordiness and could deal with a pedestrian subject in a grand manner. These examples suggest that he did not have any great instinct for scale although there is a variation in ASL from about 34 to 44 words per sentence across the pieces selected.

My findings in James S. Stewart's writings prompted me to turn to Ruskin's *Lectures on Art* [4] and in particular to the second lecture, "*The Relation of Art to Religion*" [4, p. 218] to see whether there might be a similar link with Otto's categories of the numinous and the sublime. The first result obtained was an ASL of 52.2 words per sentence - a notable increase. Sixteen sentences of over 100 words were found (one being a quotation) in nine groups. These refer to:

- (1) Plato's view of Art falsifying our conception of Deity
- (2) Pride of Faith and Pride of Science
- (3) the didactic quality of Durer's engravings

(4) the vision of the Virgin

(5) Holman Hunt's "*Light of the World*" and the suffering of Christ and of men

(6) Art serving Idolatry when we should be aware of the call of Christ to us to take up our cross

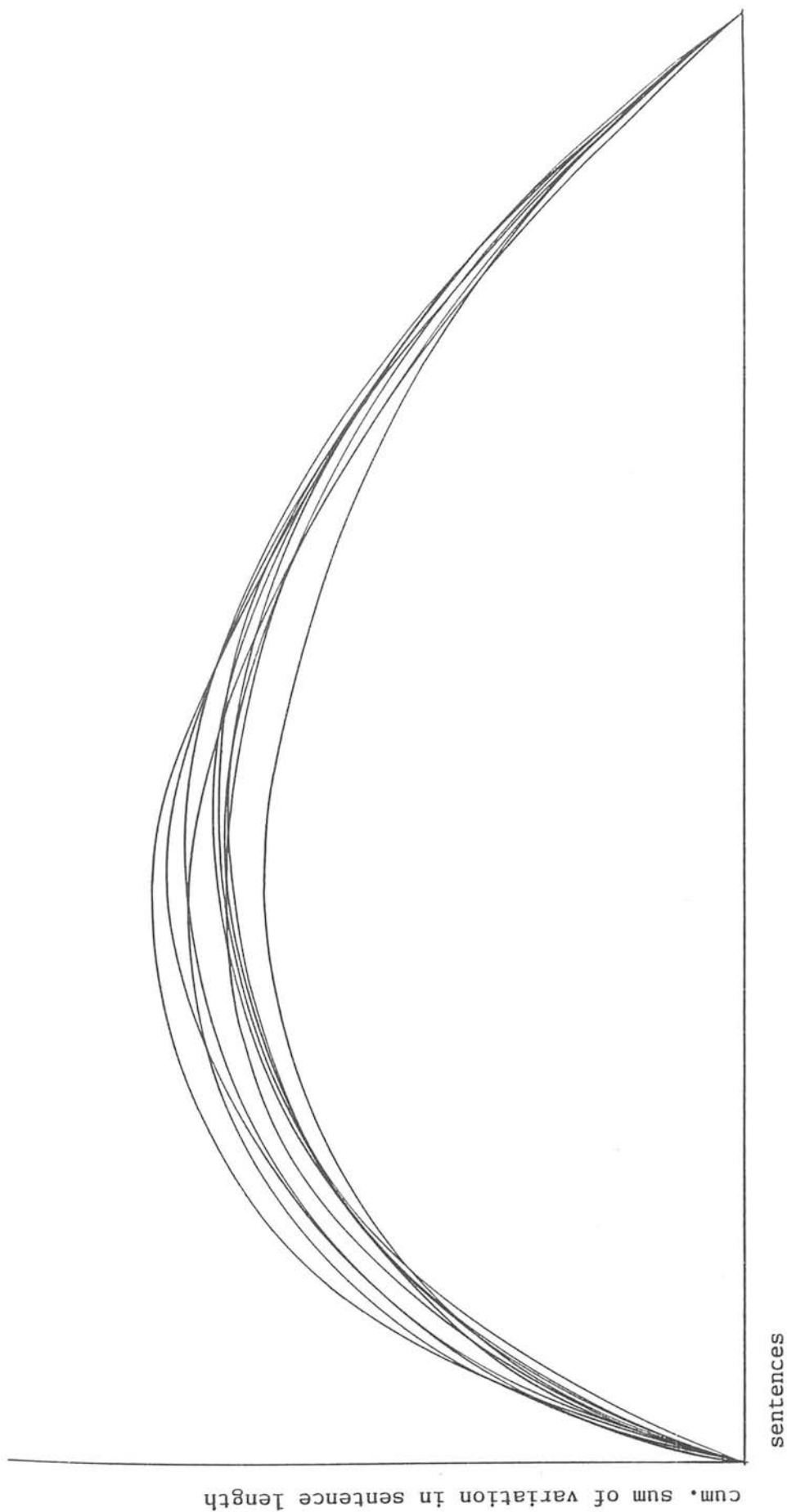
(7) standing stones and holy places

(8) the mysterious presence of Deity

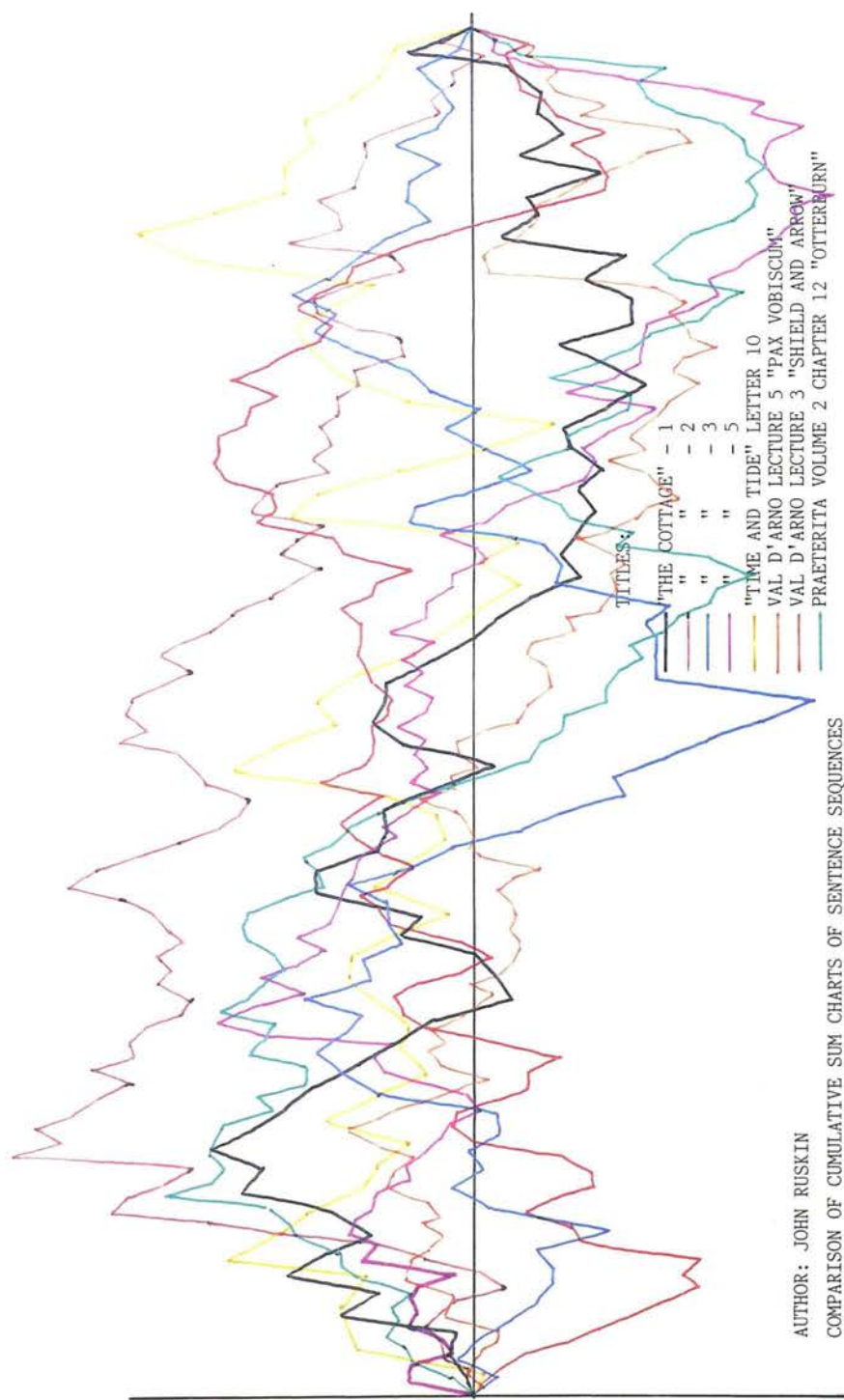
(9) the art of Man reflecting the Holiness of God.

In this lecture on art and religion we may be justified in linking the majority of these very long sentences and the increase in ASL with Ruskin's feeling for the Holy and the Sublime.

The sentence distribution curves are shown on page 101 and a collage of sentence sequence graphs on page 102.



SENTENCE DISTRIBUTION CURVES  
AUTHOR: JOHN RUSKIN - 10 WORKS



AUTHOR: JOHN RUSKIN  
 COMPARISON OF CUMULATIVE SUM CHARTS OF SENTENCE SEQUENCES  
 ON STANDARD BASE

### 3.6 THOMAS CARLYLE

In *Sartor Resartus* [1] Carlyle expresses his philosophy through the mouth of the character he has created, Professor Teufelsdröckh. At the same time, Carlyle himself observes the professor's actions, thoughts and feelings, and acts as a critic on behalf of his readers. This material presents a problem in analysis as it is in the nature of a philosophical caricature, the problem compounded by a strand of humour. Carlyle's own emotions are reflected indirectly through the text. A distinction has to be made between the element of transcendentalism in Carlyle's own thinking and the expression of his genuine sentiment through the somewhat comic figure of Teufelsdröckh. As there is an element of caricature in this writing, it may not be possible to distinguish between a true monumentality which results from the expression of genuine feeling, and a mock monumentality which is part of the craft of writing in this genre. Many of these pieces show the ordinary minor changes of pace which one might expect in homogeneous material. In the pieces which show more contrast, the features of the graphs may be related to the text. Reference should be made to the graphs on page 104 where the sections of three of these pieces are marked in red.

*Sartor Resartus*, Book 2, Chapter 6: "*Sorrows of Teufelsdröckh*" - Section 1 contains a series of visions; of a panoramic prospect of the town where the professor was born; of mountains, rugged and gigantic, full of beauty and grandeur; of a sunset viewed from a mountain top, surrounded by the stupendous masses of endless mountain ranges, with a feeling of eternity and immensity, death and life, and of communion with the Spirit of the Earth. It has considerable numinous content. ASL 39.77 words.

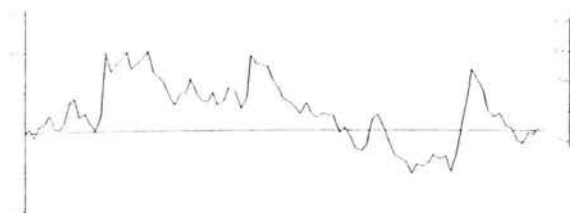
Section 2 begins "the spell was broken..." [1, p.166, line 29] and the text returns to sundry pedestrian considerations of Teufelsdröckh's seeking and journeying. ASL 21.69 words.

Section 3 is a brief summing up. ASL 36.56 words.

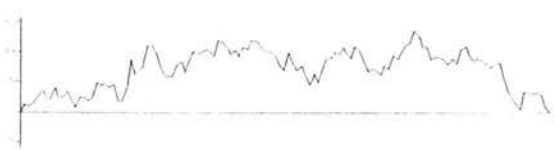
*Sartor Resartus*, Book 2, Chapter 1: "*Genesis*" - Section 1 contains a rather fantastic description of Teufelsdröckh's parents. ASL 51.64 words. Section 2 describes Teufelsdröckh's coming into the world in a fairytale manner. ASL 35.31 words.

Section 3 contains speculation and questions about his name and origin. The

SENTENCE SEQUENCE GRAPHS



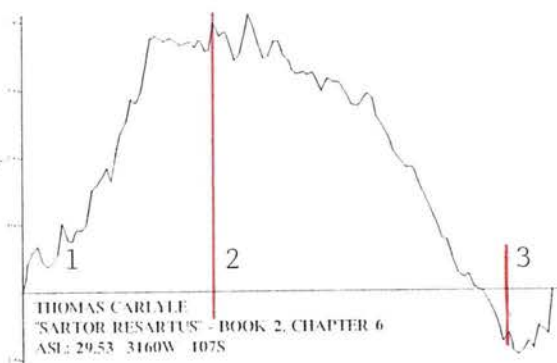
THOMAS CARLYLE  
"SARTOR RESARTUS" - BOOK 2, CHAPTER 7  
ASL: 27.8 2669W 96S



THOMAS CARLYLE  
"SARTOR RESARTUS" - BOOK 3, CHAPTER 8  
ASL: 28.42 3581W 126S



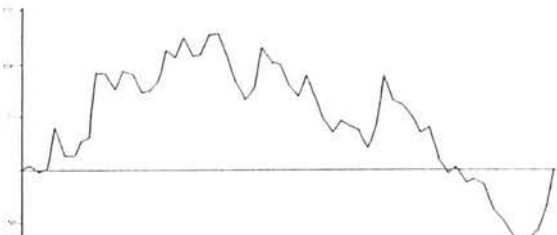
THOMAS CARLYLE  
"SARTOR RESARTUS" - BOOK 3, CHAPTER 3  
ASL: 28.83 2364W 82S



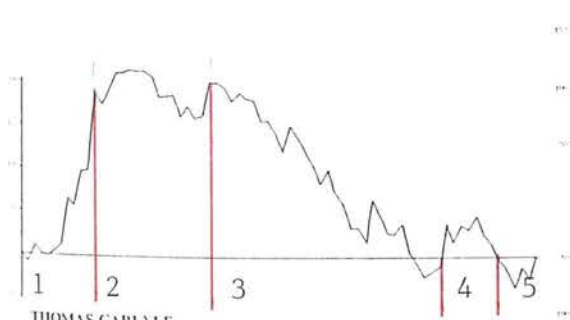
THOMAS CARLYLE  
"SARTOR RESARTUS" - BOOK 2, CHAPTER 6  
ASL: 29.53 3160W 107S



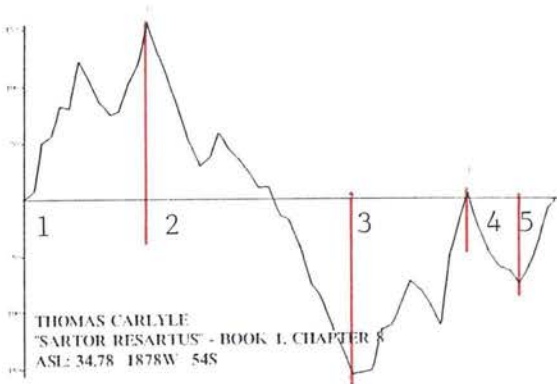
THOMAS CARLYLE  
"SARTOR RESARTUS" - BOOK 1, CHAPTER 11  
ASL: 31.72 2791W 88S



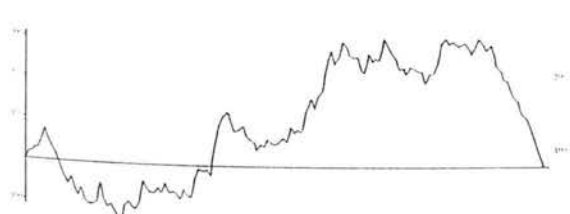
THOMAS CARLYLE  
"SARTOR RESARTUS" - BOOK 1, CHAPTER 5  
ASL: 32.79 2000W 61S



THOMAS CARLYLE  
"SARTOR RESARTUS" - BOOK 2, CHAPTER 1  
ASL: 34.59 2456W 71S



THOMAS CARLYLE  
"SARTOR RESARTUS" - BOOK 1, CHAPTER 8  
ASL: 34.78 1878W 54S



THOMAS CARLYLE  
"SARTOR RESARTUS" - BOOK 2, CHAPTER 3  
ASL: 37.26 5217W 140S



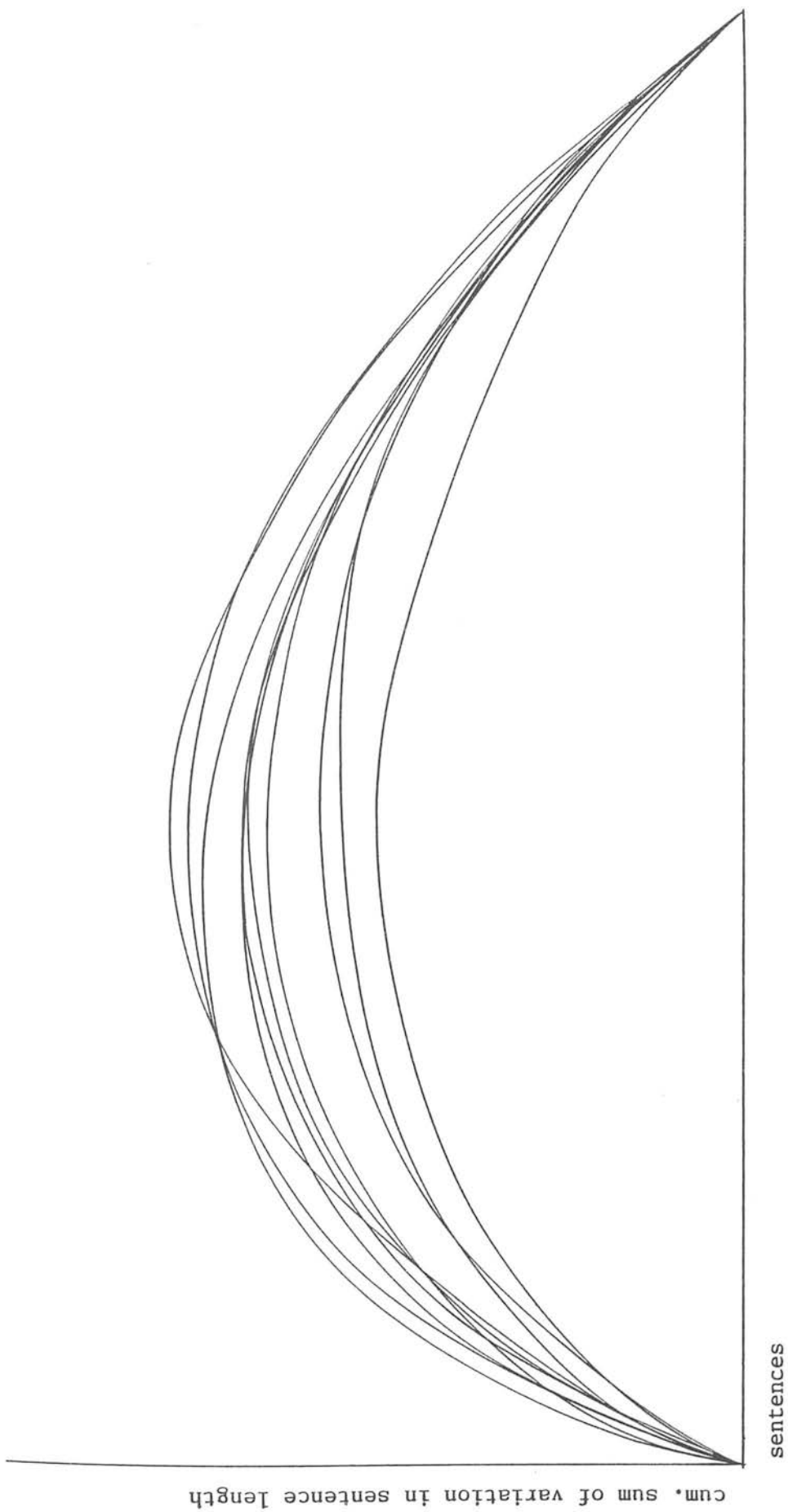
THOMAS CARLYLE  
"SARTOR RESARTUS" - BOOK 2, CHAPTER 2  
ASL: 38.14 2899W 76S

questions reduce the average sentence length.	ASL	27.74	words.
Section 4 is a description of the baby.	ASL	35.62	words.
Section 5 is a post script.	ASL	35.60	words.

<i>Sartor Resartus</i> , Book 1, Chapter 8: " <i>The World out of Clothes</i> " - This piece is sandwich of sections of mock monumental writing with strings of questions and exclamations in between. The contrast in ASL between these sections is clear. Section 1 considers the nature of Teufelsdröckh's person and philosophy ending with the question, "Who am I?"			
	ASL	46.85	words.
Section 2 consists of questions and exclamations.	ASL:	19.15	words.
Section 3 is mock monumental in style.	ASL	48.17	words.
Section 4 is mostly questions and exclamations.	ASL	18.80	words.
Section 5 is a conclusion.	ASL	53.50	words.

The sentence distribution curves are shown on page 106 and a collage of sentence sequence graphs on page 107.





SENTENCE DISTRIBUTION CURVES  
AUTHOR: THOMAS CARLYLE - 10 WORKS



### 3.7 IGNATIUS OF ANTIOCH

The text used in the preparation of graphs was that of the Loeb Classical Library, edited by Kirsopp Lake, 1912 [14].

The distribution graphs are shown on page 109, and the distribution range on page 110. The latter corresponds quite closely to the distribution range of J.S. Stewart in his lectures and sermons. The upper limit of Ignatius' range edges into the lower end of that of Isocrates. (See page 132.)

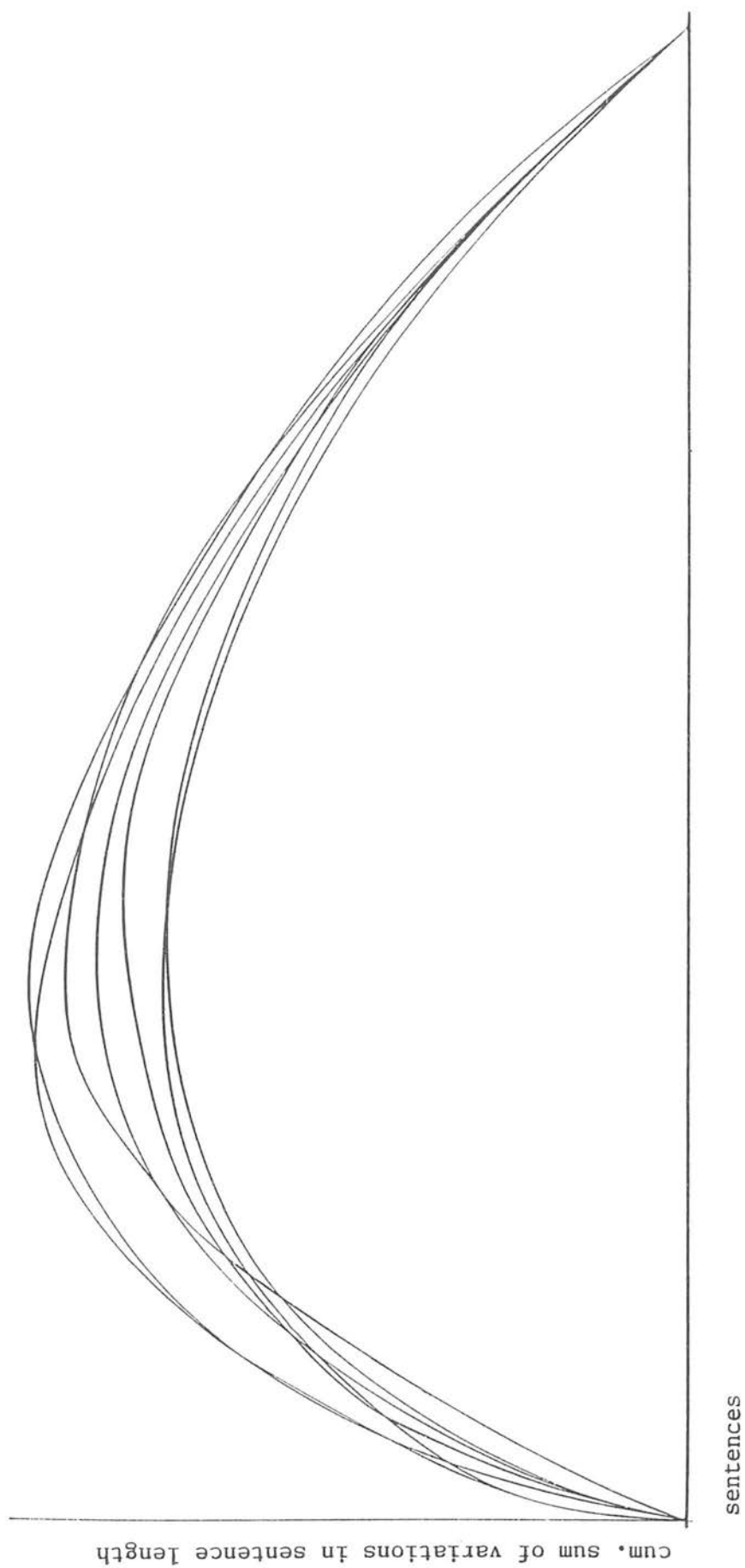
Some features are worthy of note:

The letters to Ephesians, Romans and to Smyrna have marked similarities in their overall sentence sequence pattern, as shown on page 111. (See page 150 on Prime Patterns).

Anomalies were noted in the percentage of sentences in the various letters which were extended by the use of colons. The figures are as follows:

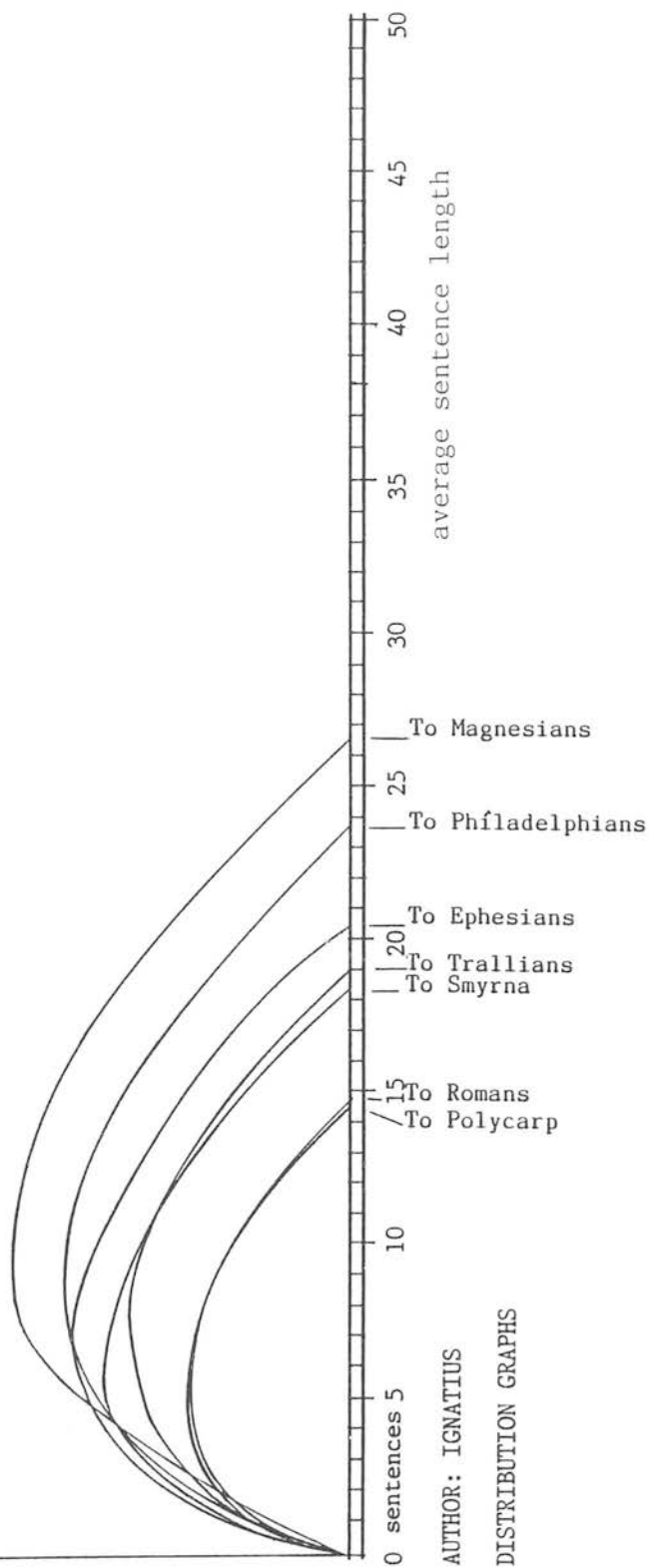
<u>Letter</u>	<u>ASL</u>	<u>% extended</u>
To Magnesians	26.55	20.00
To Philadelphians	23.70	34.88
To Ephesians	20.45	24.00
To Trallians	19.00	22.00
To Smyrna	18.47	22.58
To Polycarp	14.50	27.80
To Romans	14.63	22.86

The letter with the highest ASL (To Magnesians) has the lowest percentage extension of sentences using colons, while the letter to Philadelphians has an extraordinarily high percentage of extended sentences. The letter to Polycarp has the next highest percentage of extension, yet has



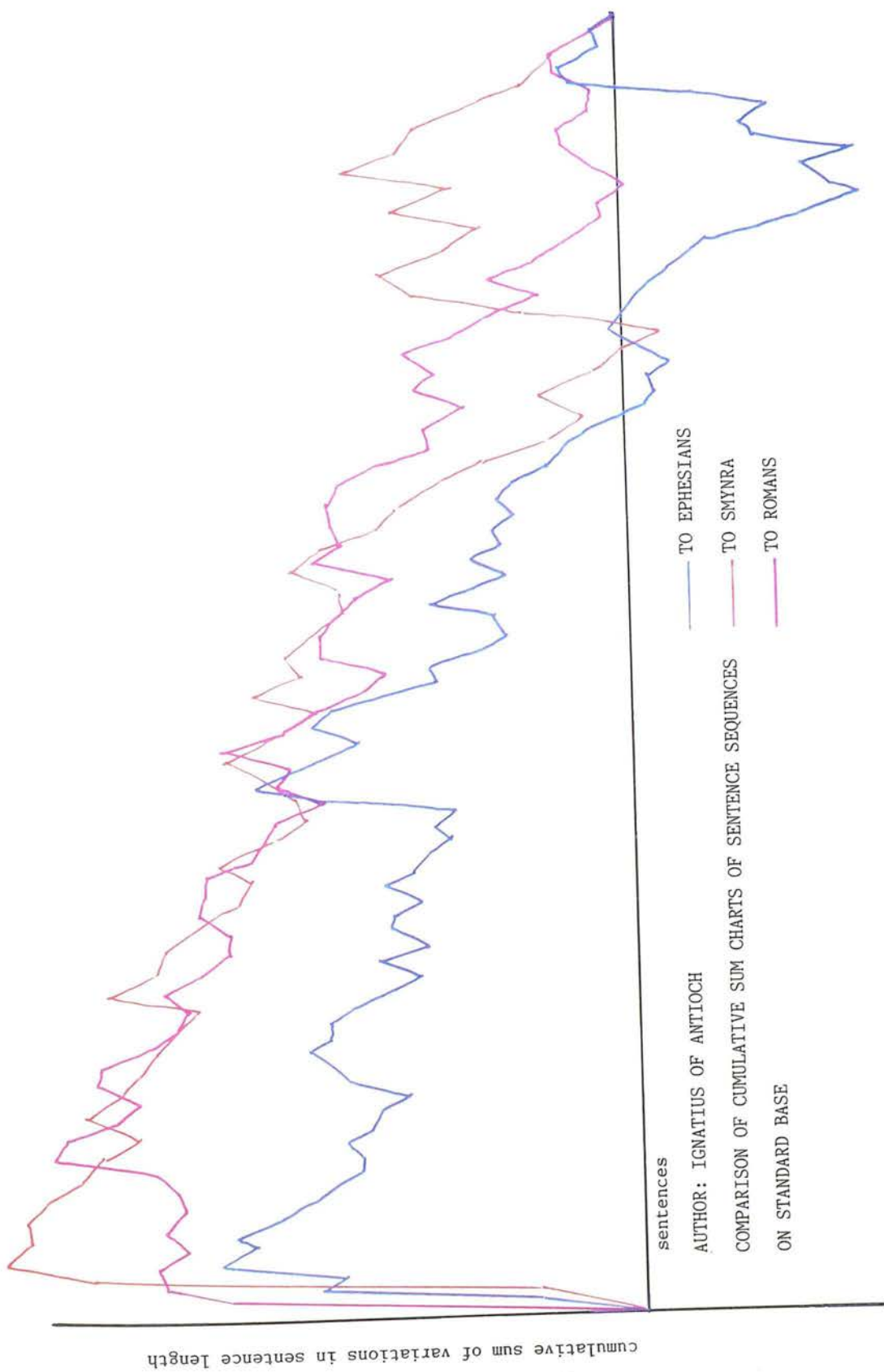
SENTENCE DISTRIBUTION CURVES  
AUTHOR: IGNATIUS - 7 WORKS

cumulative sum of variations in sentence length



AUTHOR: IGNATIUS

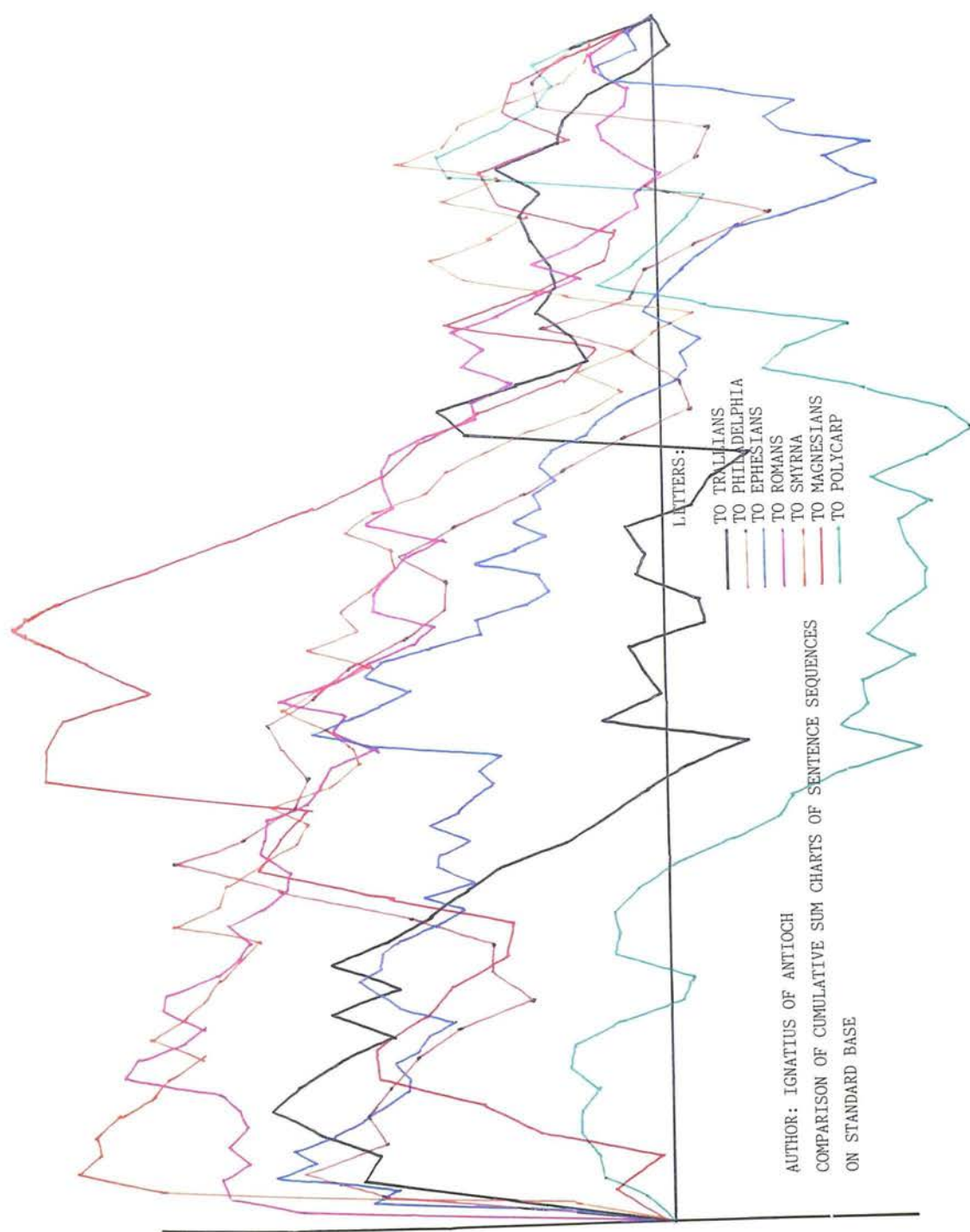
DISTRIBUTION GRAPHS



the lowest ASL. Letters to Magnesians and to Romans have widely differing ASLs (26.55 and 14.63 respectively) but a similar percentage of extended sentences (20.00 and 22.86 respectively). (See also pages 141ff. for further discussion.)

A collage of sentence sequence graphs is shown on page 113.





### 3.8 ISOCRATES

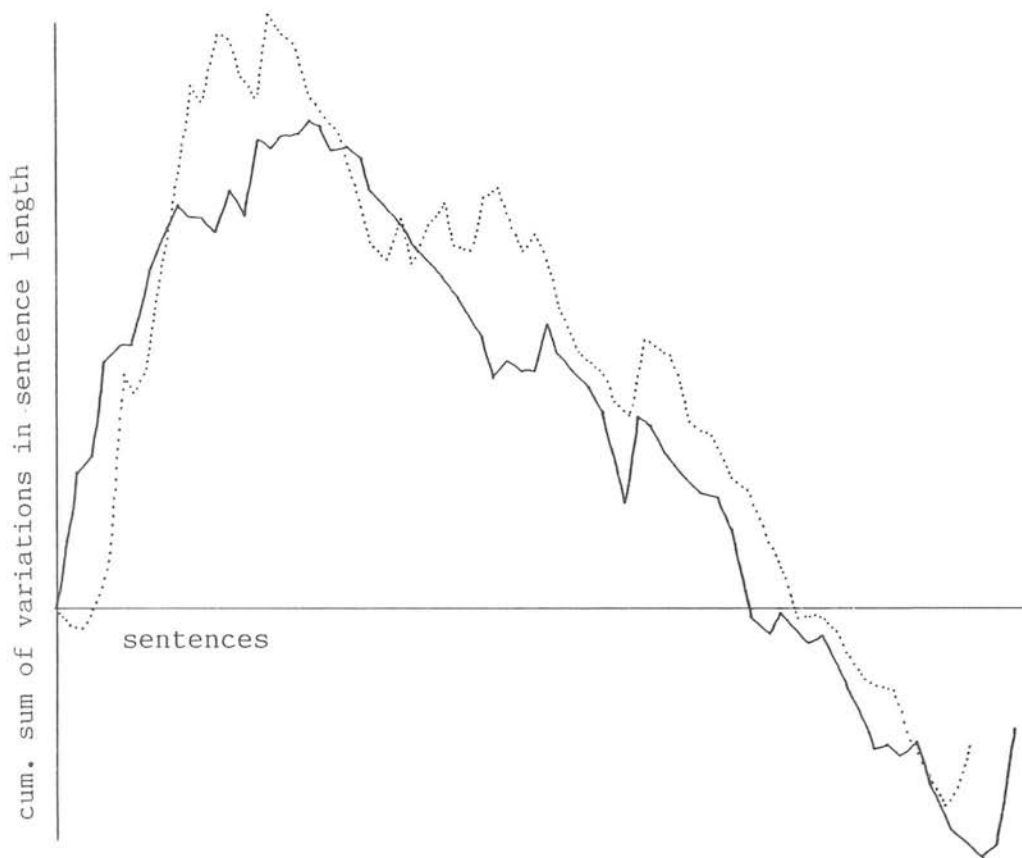
The texts used in the preparation of graphs were those of the Loeb Classical Library, *Isocrates*, Vols. 1-3 [15-17].

The distribution graphs of Isocrates' works are shown on page 117 and the distribution range on page 118. The range is extraordinarily wide. *Panathenaicus* lies at the top end of the range with an ASL of 53.58 words, and at the low end lie six early works which Isocrates in his later years considered to be "unworthy".

Of these six unworthy works, one provides too short a sample while another is a fragment. The remaining four are shown in dashed lines on page 117. *Ad Demonicum*, the authenticity of which some have challenged, is shown in a dotted line. These works are spread right across the range of typical distribution shapes provided by the other works. The graph of the distribution range (page 118) shows that these four "inferior" works cluster at the low end of the range.

Morton writes in *The Authorship of the Pauline Epistles* [47, p. 14], "The contrast between the first work in the Corpus of Isocrates, which is spurious in the opinion of all scholars, and the rest of the Corpus, which are genuine, is clear." That is something of an overstatement regarding the views of scholars, and the statistical examination of the Corpus may suffer from not taking scale into account. On page 115 the opening sequences of *Ad Demonicum* and *Philippus* are compared, with adjustment being made for the differences in ASL which are 23.93 words and 37.46 words respectively. The movement is similar and common motifs appear. Considering the wide variety of sequence patterns which may be found not only between authors but within one author's work, it would be a remarkable coincidence if these works came from different hands.

The four works also cluster chronologically, as the Table on page 119 shows, and as the form of the distribution of *Ad Demonicum* is compatible with the rest, it may be that that work is also early. Various dates have been suggested - 404, 393 and 372 BC. The graphs suggest that it should be grouped with the earliest of Isocrates' surviving works.



ISOCRATES: OPENING SENTENCE SEQUENCES ADJUSTED FOR SCALE

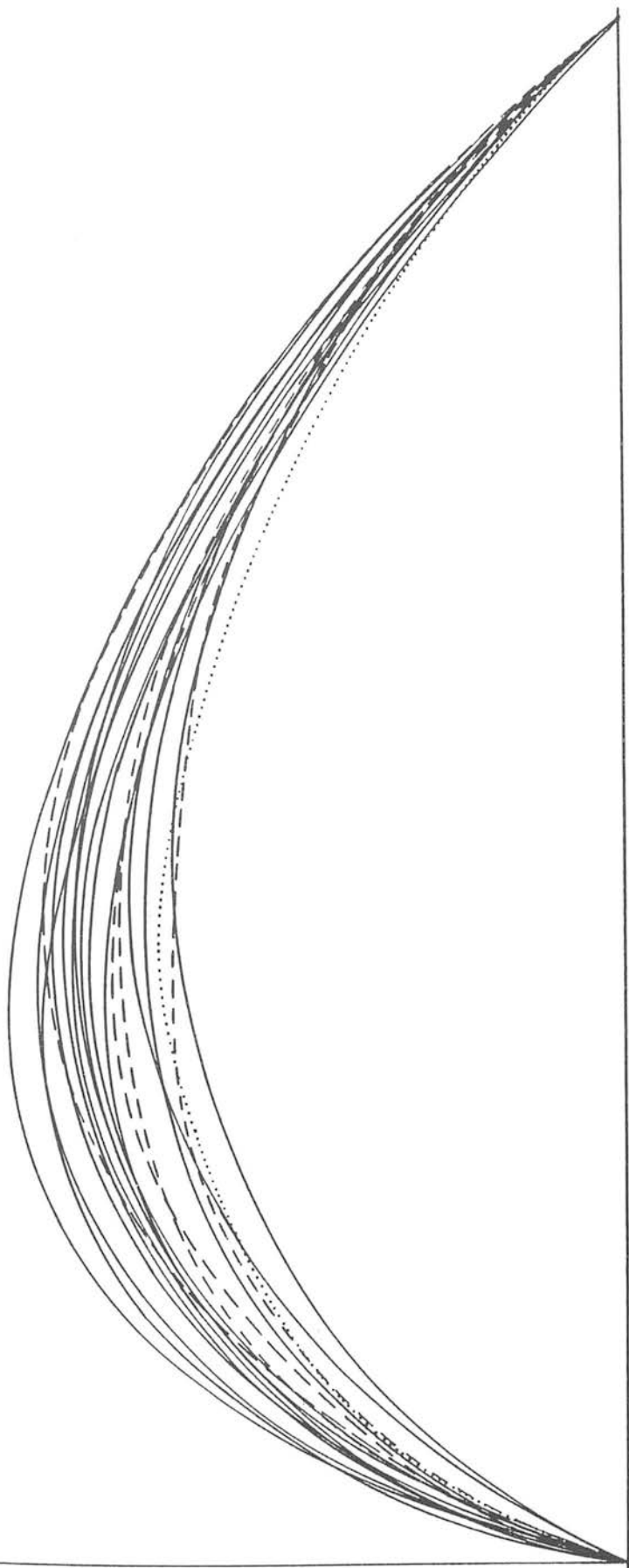
..... Philippus ASL: 37.47

———— Ad Demonium ASL: 23.93

It is noted that *Ad Demonicum* lies at one end of the distribution range. It is to be expected that disputed works will tend to lie at the extreme ends of the distribution range; they are borderline cases. In the case of Isocrates, *Panathenaicus* lies at the top end of the range and is accepted; *Ad Demonicum* lies at the low end and is treated with suspicion. In the Pauline letters the reverse is the case. Those at the low end (Romans, Corinthians, Galatians) are accepted as Pauline, but the authorship of those at the other extreme (Ephesians and Colossians) is a controversial matter.

Data concerning the works of Isocrates are shown on page 119, and a collage of sentence sequence graphs on page 120.

cumulative sum of variations in sentence length

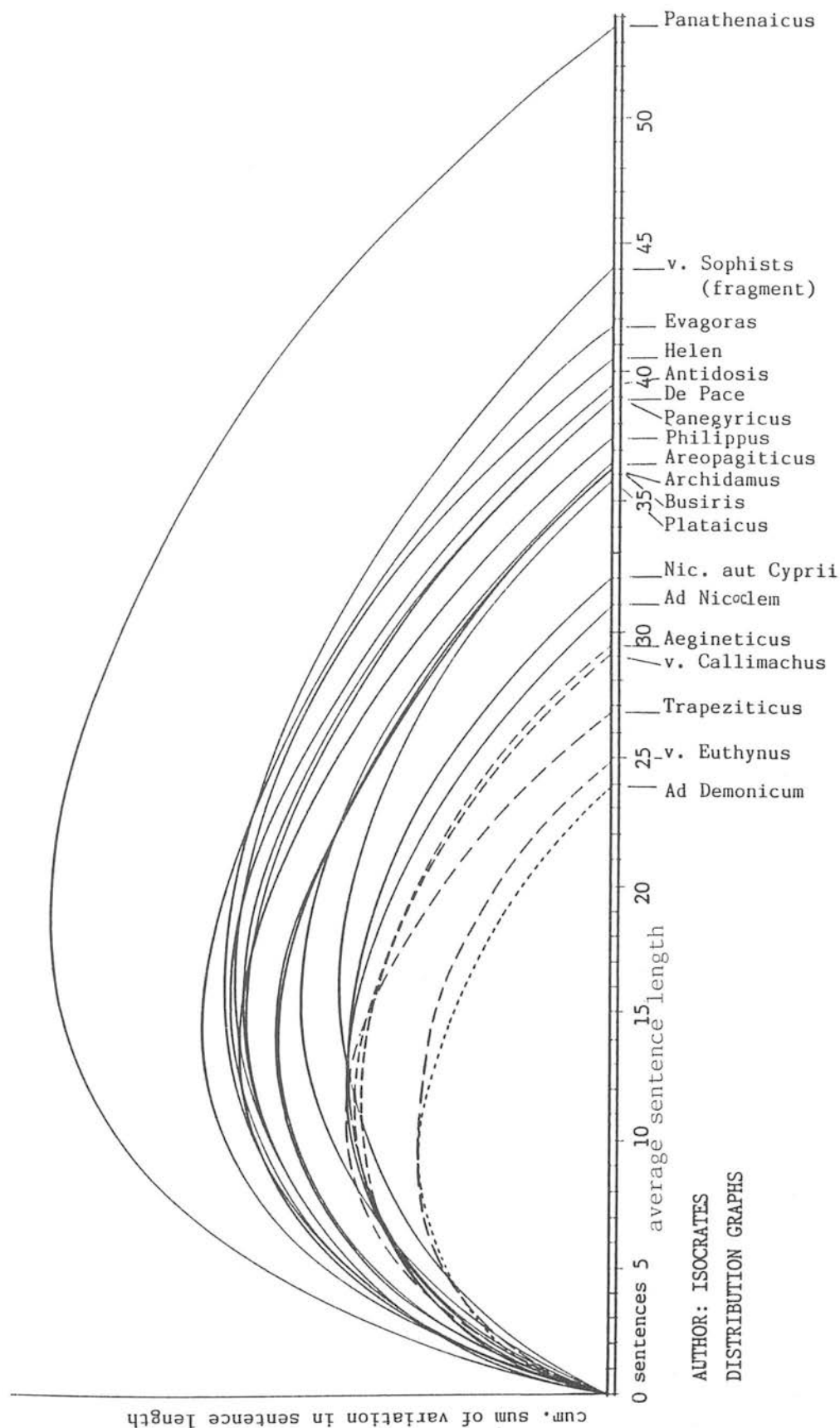


sentences

AUTHOR: ISOCRATES

..... AD DEMONICUM

--- AGAINST EUTHYNUUS, AGAINST CALLIMACHUS, AEGINETICUS, TRAPEZITICUS (Early works  
which Isocrates later considered to be unworthy)

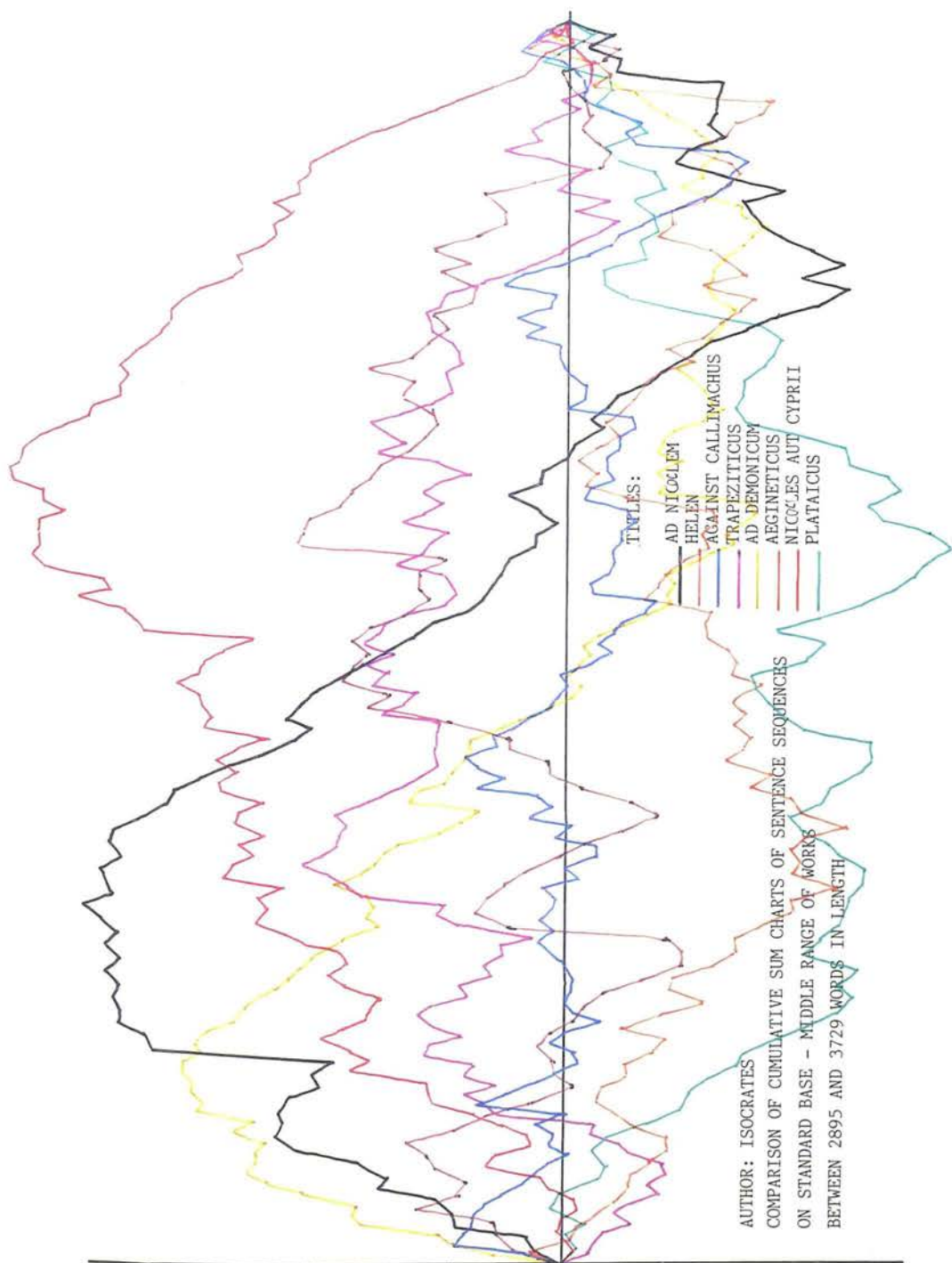


AUTHOR: ISOCRATES  
DISTRIBUTION GRAPHS

ISOCRATES

<u>TITLE</u>	<u>ASL</u>	<u>% EXTENDED</u>	<u>DATE BC</u>
AD DEMONICUM	23.93	54.5	404/393/372
AGAINST EUTHYNUS	24.86	31.8	c403
AGAINST CALLIMACHUS	29.20	25.4	402
AEGINETICUS	29.52	28.3	c394
TRAPEZITICUS	26.78	21.8	393
AGAINST THE SOPHISTS (A FRAGMENT)	44.13	33.4	390
BUSIRIS	36.16	31.6	390/385
PANEGYRICUS	38.80	25.8	380
AD NICOCLEM	30.99	39.2	374
PLATAICUS	35.74	33.7	373
NICOCLES AUT CYPRII	32.05	31.2	372/365
HELEN	40.53	39.1	c370
EVAGORAS	41.77	38.2	370/365
ARCHIDAMUS	36.26	25.4	366
DE PACE	38.88	32.7	356
AREOPAGITICUS	36.50	40.0	355
ANTIDOSIS	39.49	33.4	354/353
PHILIPPUS	37.46	27.8	346
LETTER TO PHILIP	37.59	35.3	342
PANATHENAICUS	53.58	38.3	339



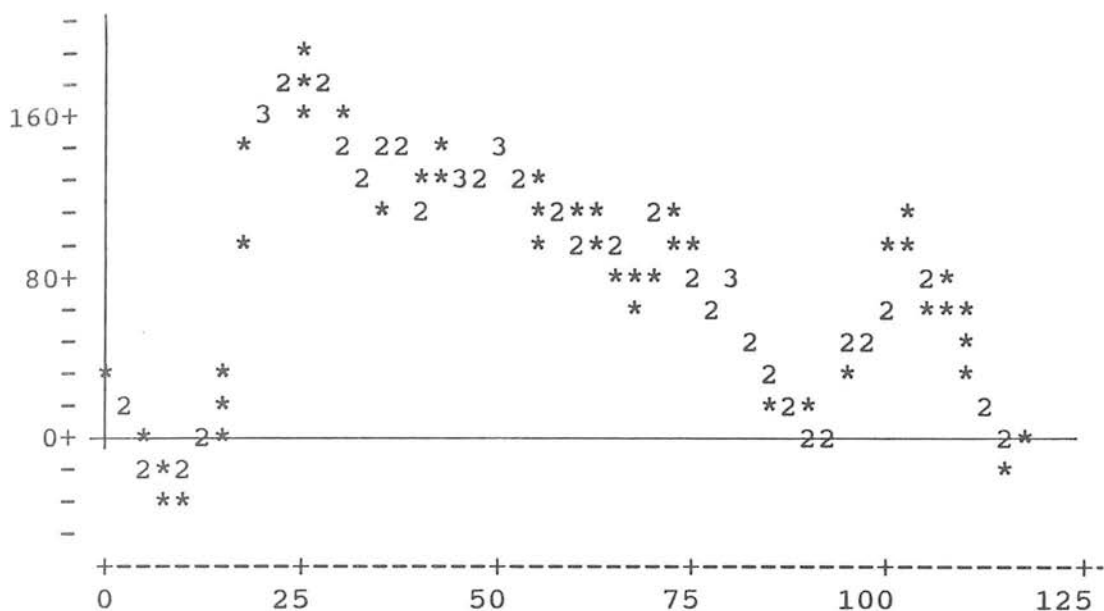


### 3.9 ISAEUS

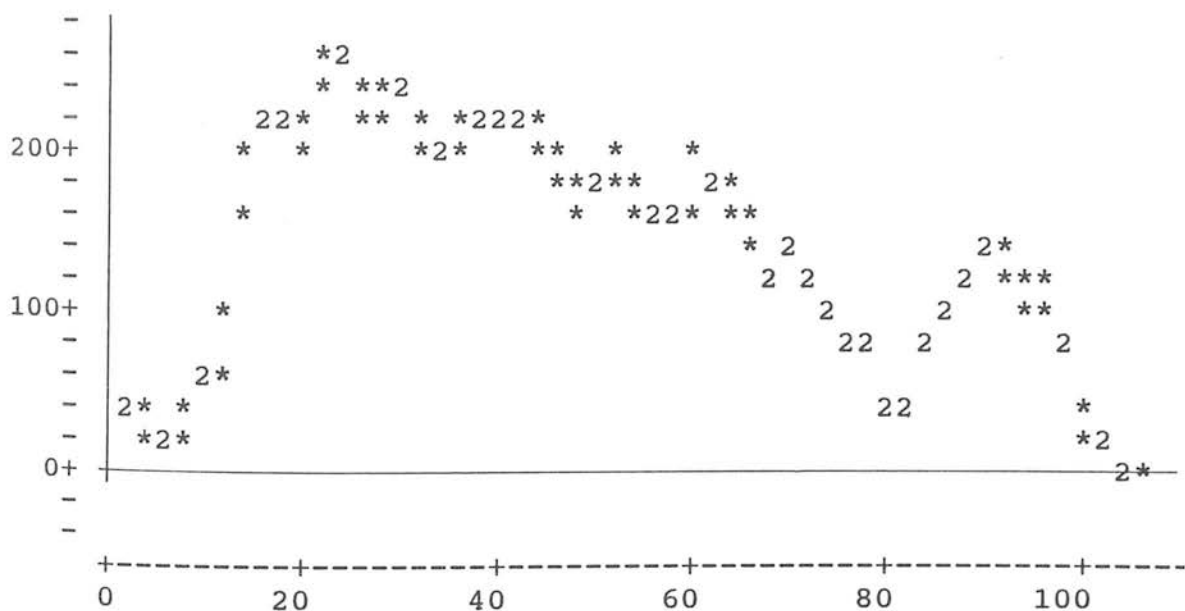
The texts used in the preparation of graphs were those of the Loeb Classical Library, edited by E.S. Forster, 1927 [13].

A minor adjustment was required in the punctuation of these speeches. They contain some brief instructions of a few words in length: these have generally been taken in with the previous sentence. (See pages 189ff. for a fuller discussion of the problem posed by very short word groups like "Amen" and "Hallelujah!" which have an undue influence on the cumulative sum graph.) Some very short questions of two or three words have also been coupled with adjacent sentences. The comparison on page 122 shows that this smoothes out the local variations without having a significant effect on the underlying characteristics.

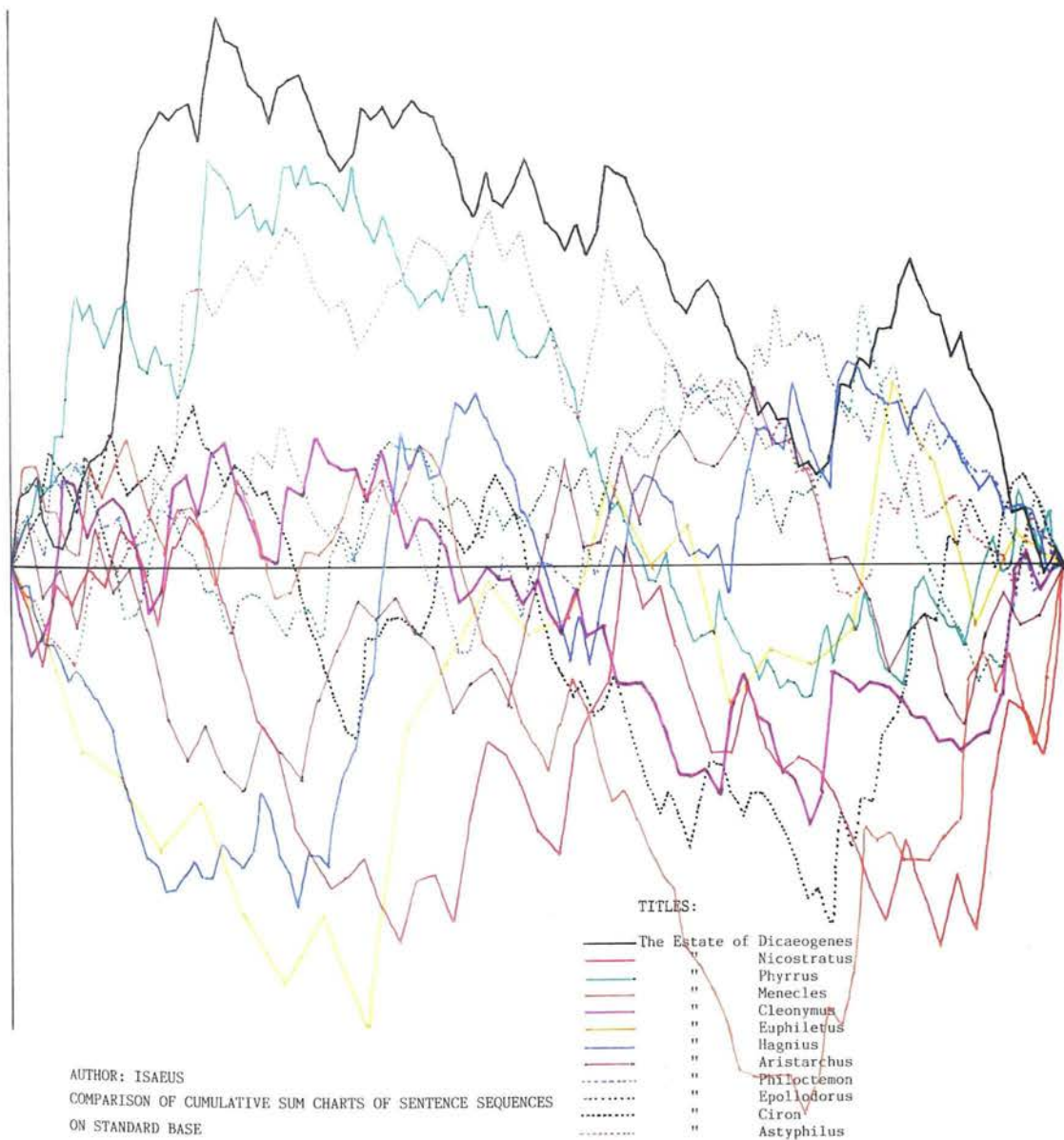
This material has some remarkable features. The collage of sentence sequence graphs (page 123) shows the great variety of construction to be found in Isaeus. There is no standard opening pattern. Isaeus is as likely to begin a speech with sentences of under average length as he is with sentences of over average length. There is no consistency in overall form though there are occasional parallel passages. The writing has great contrast in terms of sentence length, as can be deduced from the height of the distribution graphs (page 124). The remarkable feature is that these contrasts average out, and the distribution graphs occupy a narrower slot in the distribution range (page 125) than those of any other writer, ancient or modern, included in this study.



ISAEUS: THE ESTATE OF DICAEOGENES  
 SENTENCE SEQUENCE GRAPH USING FULL STOP SENTENCES



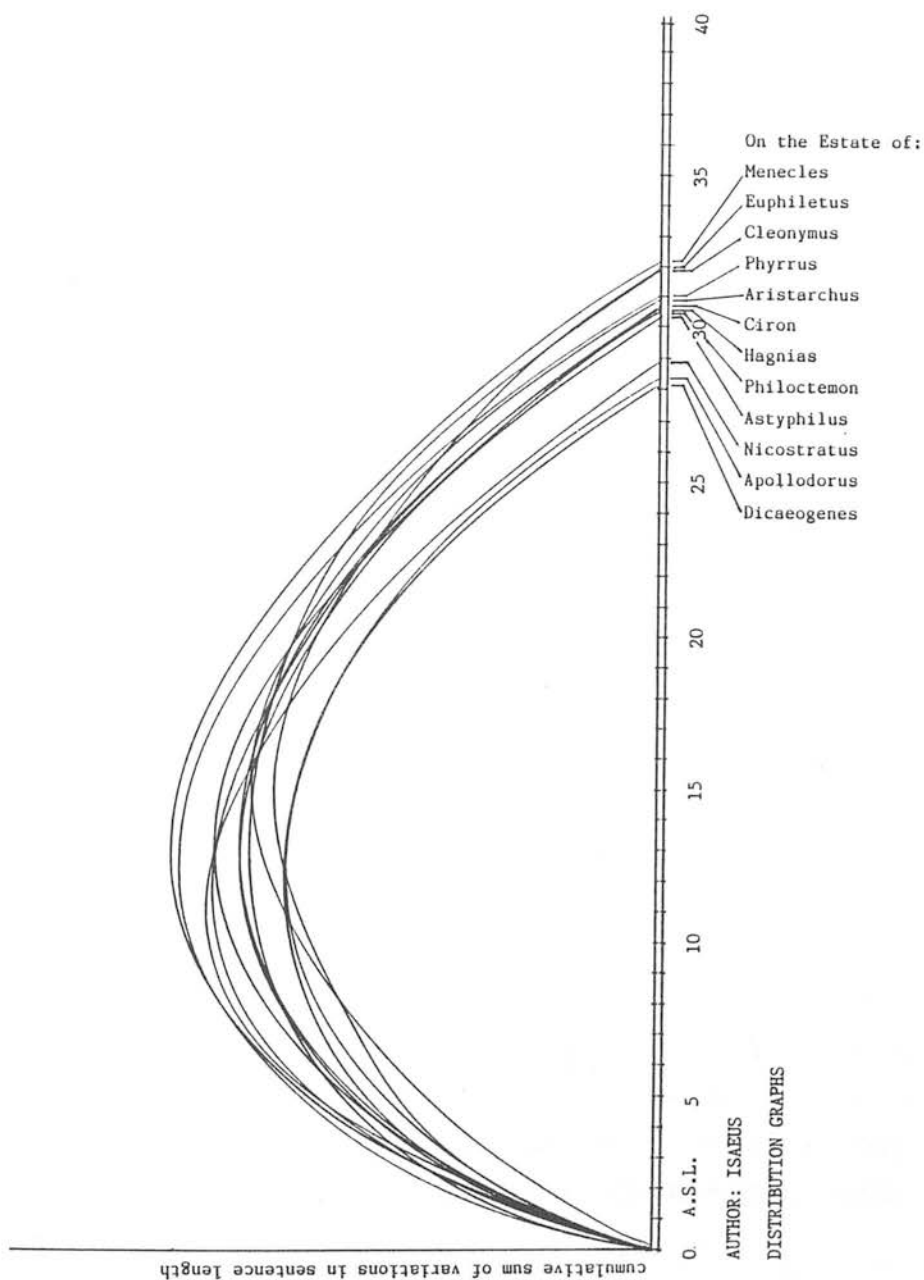
ISAEUS: THE ESTATE OF DICAEOGENES  
 SENTENCE SEQUENCE GRAPH WITH LEGAL INSTRUCTIONS  
 GROUPED WITH ADJACENT SENTENCES





SENTENCE DISTRIBUTION CURVES

AUTHOR: ISAEUS - 12 WORKS



## 3.10 SYNOPSIS

A review of the above test material identifies several features which will be found to be of significance in the examination of the New Testament material. The most striking of these is the difference in ASL which varies from section to section and which is associated with changes in genre. In my first assessment of the Pauline letters, comparisons were made between the overall patterns of the various epistles. The close examination of the test material in this chapter shows how important it is to relate the patterns to the content of the text, section by section, and to detect the changes in genre within the text. This is seldom done in statistical studies which concentrate on the frequency of occurrence of various features.

The appearance of motifs of intermediate scale is also significant. In Stewart's sermons these are very directly related to numinous content, Ruskin and Carlyle showing similar features related to the numinous or the sublime. The short stories of O. Henry and Barbara Erskine demonstrate how ASL is affected by conversational constructions and changes in pace.

The Greek authors also provide evidence of intermediate scale patterns, particularly Ignatius. The graphs of Isocrates' works provide evidence concerning the authorship of *Ad Demonium* which has not hitherto been available.

### 3.10.1 Motifs

In this study the word *motif* is always used in a graphical sense. It does not refer to the literary content of the texts but to small scale graphical patterns. These may on occasion be related to the content of the text, or they may simply reflect a rhythm which an author habitually falls into.

Recurring patterns at small scale can be seen in some of the graphs, notably in those of James S. Stewart where the motif contains a very long sentence which is usually related to the numinous content of the text (pages 72ff.). The features of the motif are clear but the dimensions vary considerably and are quite unpredictable. This relationship between sentence



length and the numinous or the sublime is also found in Ruskin (pages 99f.) and Carlyle (pages 103ff.). These motifs in Stewart's work are small in scale and occupy only small portions of a graph. In the graphs of my own sermons, an example is given (page 83) of a sermon constructed by assembling three independent blocks of material, this being reflected in the form of the graph. Another example is given (page 82) of two works in which the underlying structural form is similar over the whole extent of the sermon, though the detail of the trace varies within each section. Ignatius provides a set of three graphs (page 111) which have common features covering almost the whole of the works. The significance of these larger scale motifs will be discussed later in the section on Prime Patterns in Chapter 4 (page 148).

### **3.10.2 Shape of Sentence Sequence Graphs**

In many sentence sequence graphs the shape results from the contrast between sections of material of different genre, or of varying mood, or with different syntactical features. The sections of my sermons, reflecting different moods, may have widely varying ASLs - an example on page 82 notes adjacent sections with ASLs of 15.40 words and 31.12 words. In short stories, the contrast may be between sections of descriptive storytelling and sections of conversation; an example on page 88 notes adjacent sections with ASLs of 9.69 words and 26.92 words. The contrast may be between philosophical writing and strings of questions and exclamations (see Carlyle on page 105). The overall pattern may result from the assembly of sections of such different character - a feature which will be found to be of considerable importance in the study of the Pauline epistles in which theological and ethical sections are placed side by side. This raises the question of homogeneity (see page 168) which in Carlyle's case is further complicated by the very craft of writing in which moods may be conjured up which are not necessarily those of the author, but which may be reflected in the structure of the prose.

### 3.10.3 Sentence Extension

The anomalies noted in Ignatius (page 108) and in Isocrates (page 119) in which there is a variance between the ASLs of different works and the percentage of sentences extended by the use of colons, semicolons, parentheses etc. points to a possible scale difference between works. This is given further consideration in Chapter 4, pages 141ff.

### 3.10.4 Punctuation

The small adjustments required in the punctuation of the texts of the works of Isaeus are a first indication of several questions regarding the punctuation of Greek texts which will be considered in detail in Chapter 5, pages 189ff.

### 3.10.5 Areas of Overlap

It must be emphasised that the areas of overlap detected in the graphs of the various authors' works refer only to the selected samples and not to the whole output of the authors. These areas of overlap show where the characteristics of one author's writing are indistinguishable from those of another author, in terms of the shape of the sentence distribution, or in terms of both the shape and range of sentence distribution. They are seen in the following charts:

Shape of sentence distribution in English authors - page 129.

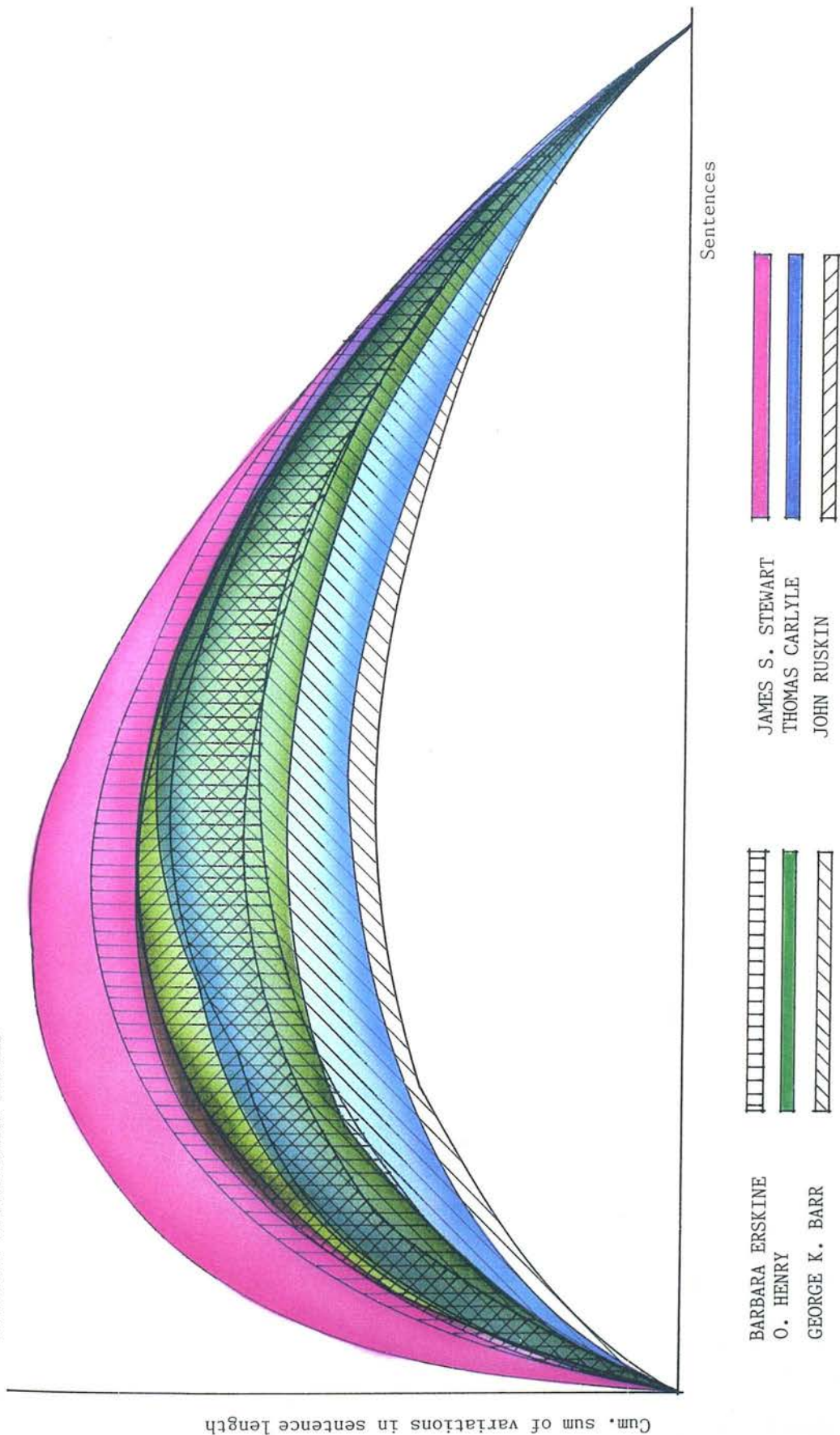
Shape of sentence distribution in Greek authors - page 130.

Range of sentence distributions in English authors - page 131.

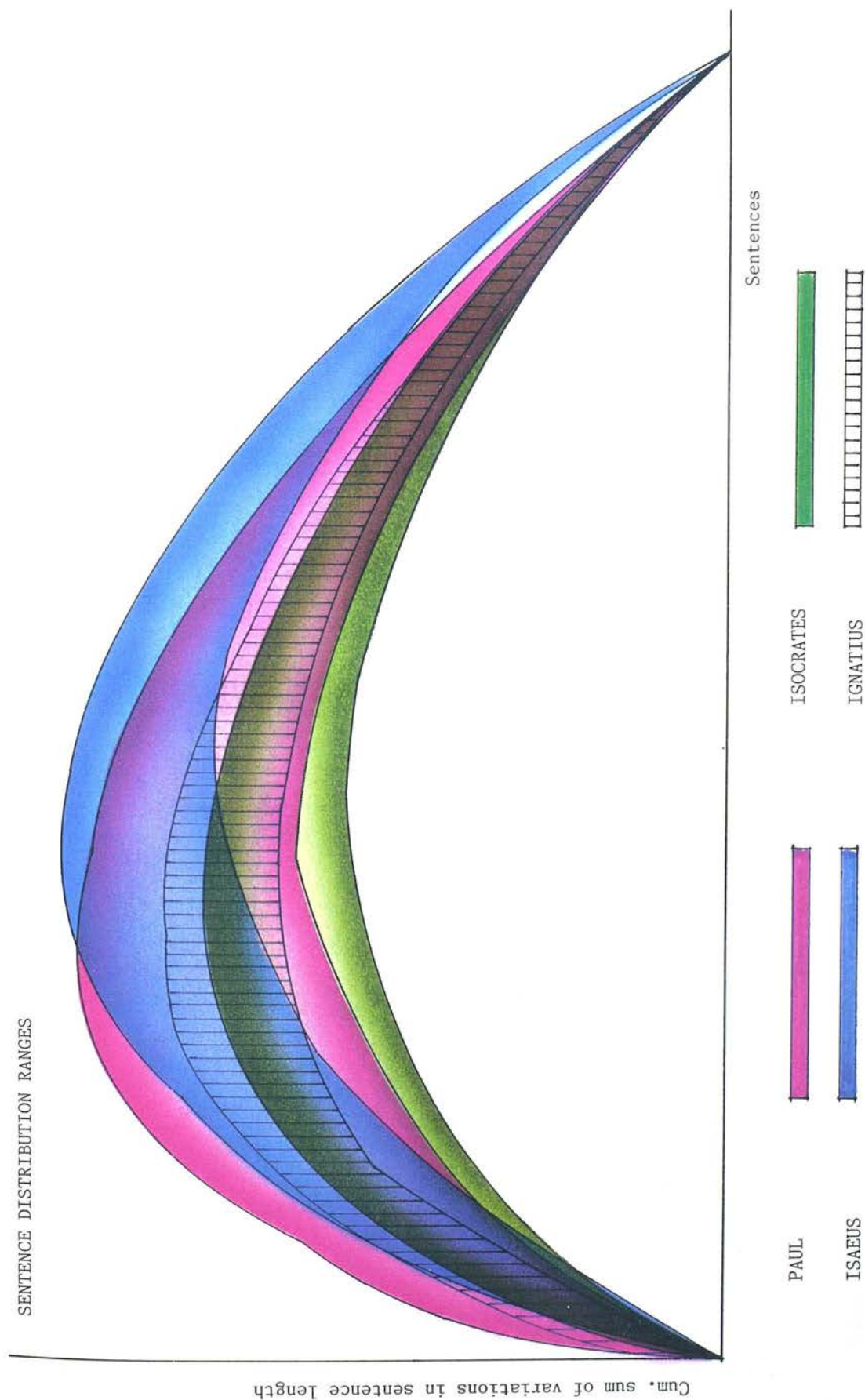
Range of sentence distributions in Greek authors - page 132.

On the last two of these, the ranges are termed "scale ranges". They are in fact distribution ranges, but they do also indicate something of the shape of the distributions. The justification for terming these "scale ranges" will be given in Chapter 4, page 140, where the scale element is identified.

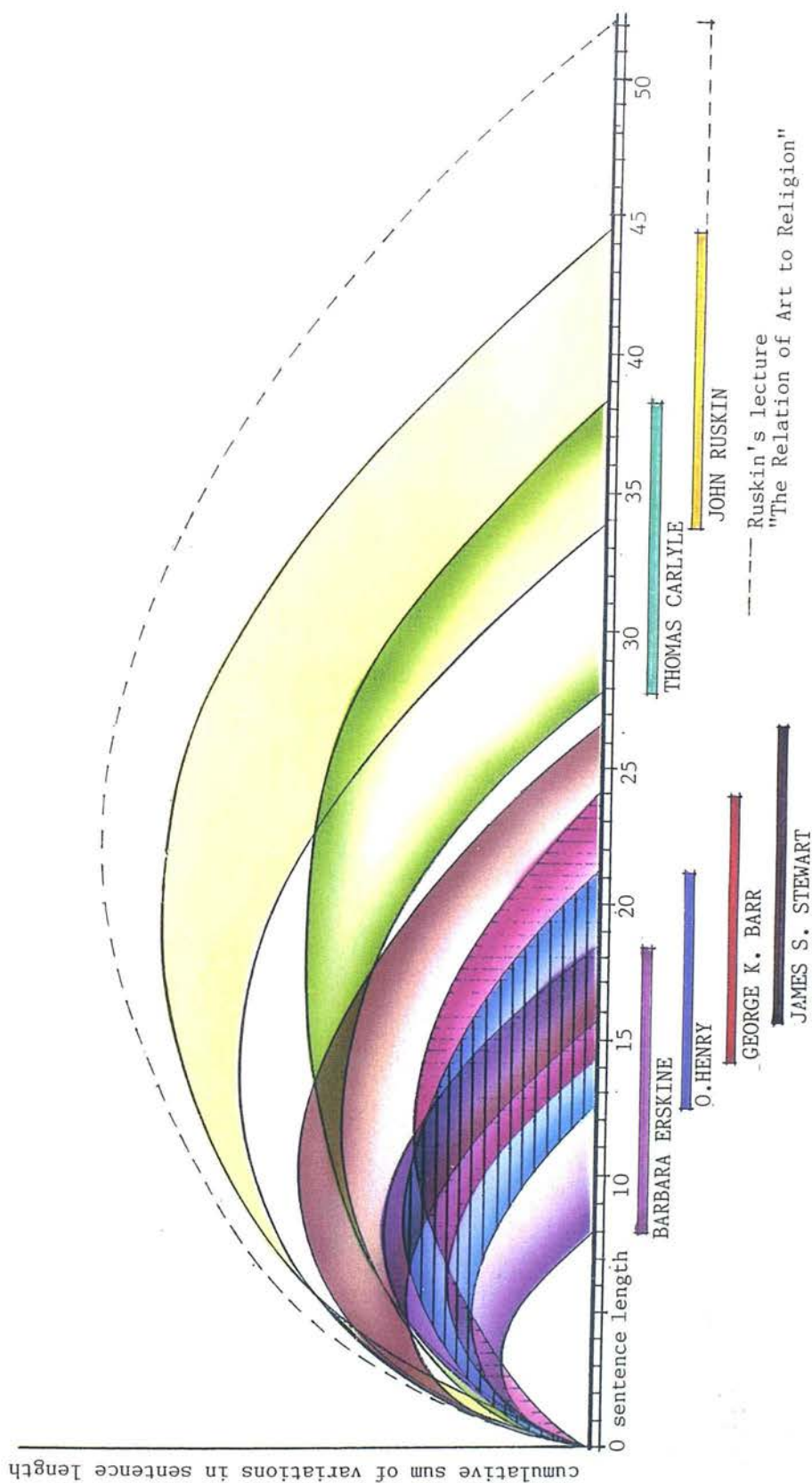
# SENTENCE DISTRIBUTION RANGES



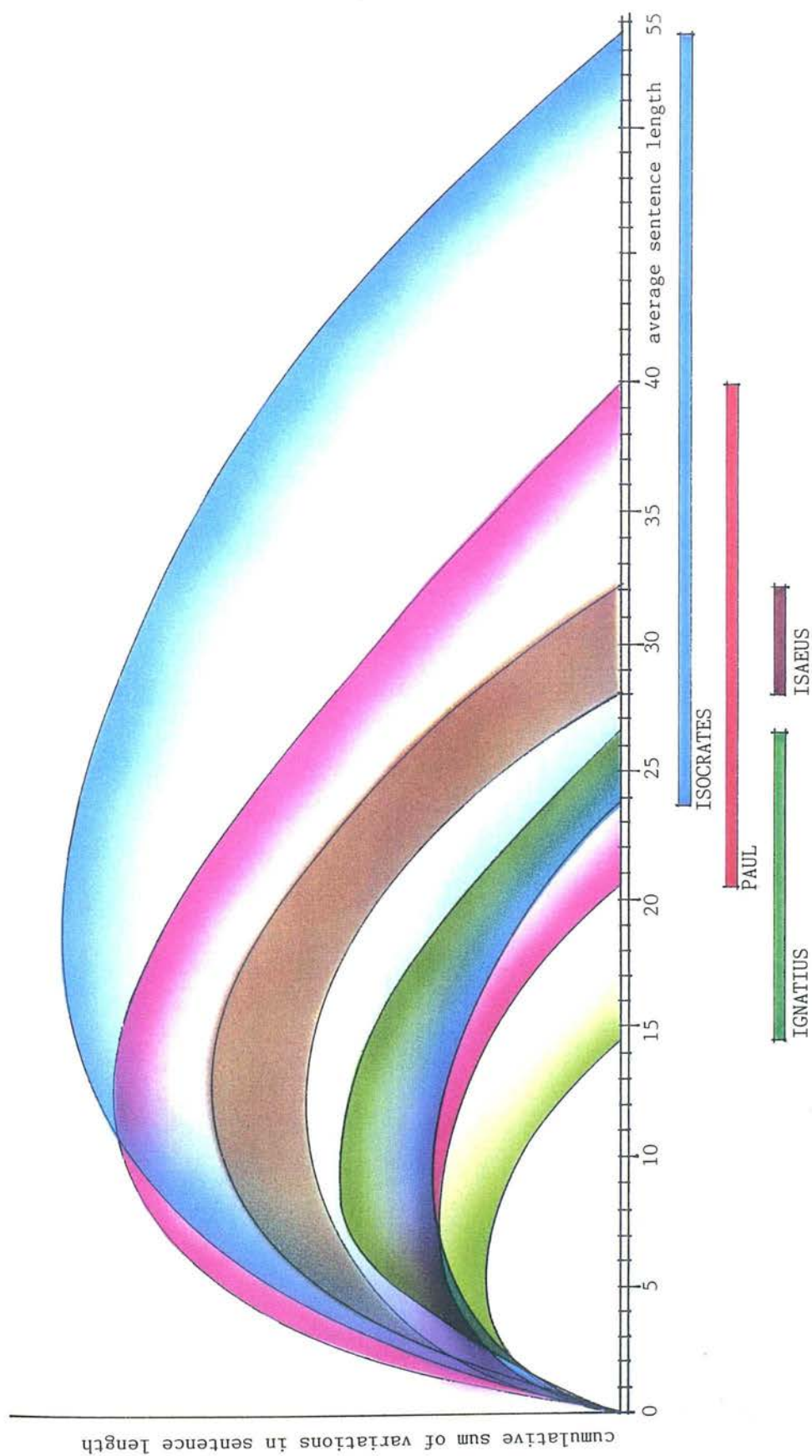
# SENTENCE DISTRIBUTION RANGES







COMPARISON OF SCALE RANGES OF MODERN ENGLISH AUTHORS



COMPARISON OF SCALE RANGES OF GREEK AUTHORS

These charts indicate to what extent sentence length may be regarded as a discriminator between the samples of these particular authors. In the chart of the Greek authors (page 132) an indication of the scale range of the Pauline epistles has been included. This is only approximate as it was based on one particular assessment of the punctuation of the letters, but is sufficient to give a general comparison. While the Pauline scale range occupies a broad band compared with those of Ignatius and Isaeus, it is quite modest compared with the wide range of Isocrates.

The collages of sentence sequence graphs contained in sections 3.1 to 3.9 may be compared. Some characteristics, such as the motif in James S. Stewart's works, are more evident than others. The purpose in preparing these collages is primarily to allow comparison later with distinctive patterns in the Pauline epistles (pages 281-4).



## CHAPTER 4

### Scale and Textual Patterns

In this chapter, various aspects of scale are examined in detail. The scale component is quantitatively identified in sentence distribution patterns, in methods of sentence expansion, and in the patterns of sequences of sentences. It is demonstrated that pairs of works of different lengths by one author may have sentence distributions which are of different dimensions, yet are in proportion to one another, thus showing scale differences. Other pairs of works by the same author may have a constant texture throughout; that is, they may have similar ASLs and show no scale differences, yet be of different length. Similar scale variations are found in the expansion of sentences by means of colons and semicolons.

Sentence sequence patterns give a recognisable picture of the "shape" of a piece in terms of sentence lengths, and it is found that different pieces by one author may provide similar shapes, even though they are conceived at different scale levels and there is a difference in ASL. Examining the circumstances under which an author has produced works with such similar shapes, leads to the identification of "prime patterns", and an understanding of the circumstances which produce these and secondary patterns. Some authors may repeatedly produce small patterns covering groups of sentences which appear as minor graphical motifs, while others are capable of producing repetitive patterns covering whole works.

Questions of sentence length, sentence definition (especially of the Greek texts), and the usefulness of examining units larger than the sentence

are pursued. An examination of modified full stop sentences (MFSSs) and block sampling, reveals the dangers of failing to recognise that scale changes may occur internally between sections of a work. This raises the question of homogeneity, and it is demonstrated that differences in ASL occur between sections of all the Pauline epistles - differences which are comparable with those which lie between whole epistles. It is shown that if the Pauline corpus cannot be considered to be statistically homogenous with regard to sentence length, then an absurd situation exists regarding the authorship of each individual letter.

Decisions have to be made concerning the handling of questions, quotations, glosses and lists, and these are noted. A brief examination is made of the relationship between scale and the passing of time, in the sense of chronological development, in relation to "prime patterns", and in relation to the use of material stored in the memory in a particular form.

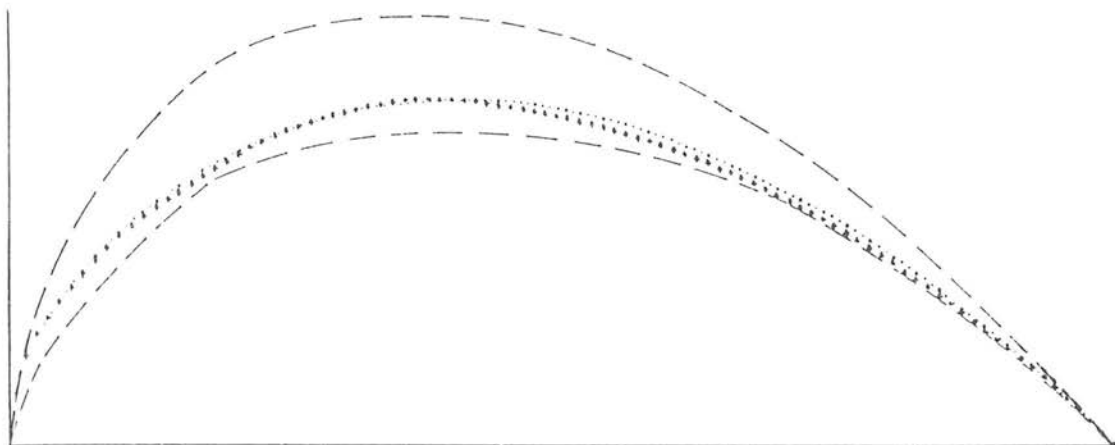
Finally, a note is included concerning scale and chaos, as it seemed important at one point to examine the scaling effects found in the mathematics of chaos. This matter turned out to be of secondary importance and the material has been included in Appendix B.

## 4.1 Scale and Sentence Distribution

In Chapter 2 a method was given for the comparison of the typical "shapes" of sentence distribution found in the work of different authors. The graph on page 70 shows the range of distribution curves derived from the samples of James S. Stewart's work. On page 129 that range is compared with the ranges of shape found in the works of other authors. In that comparison it is seen that there is some overlap between the different authors' ranges. What is being compared in that instance is the shape of the sentence distribution, i.e. the relative proportions of longer and shorter sentences. The actual size of the sentences is not taken into account. When the distribution curves are drawn on a base representing average sentence length (page 131) then the actual sizes of the sentences are taken into account and rather different areas of overlap are found.

Within these graphs there are two variables, one being variation in the shape of the distribution, and the other being variation in average sentence length. To isolate the scale element one of these variables must be eliminated. The variation in shape may depend on several factors; study of my own work suggests that an important element is the mood of the writer. Mood can affect the contrast between the longer and the shorter sentences resulting in lively writing or in dull, monotonous writing. This degree of contrast is reflected in the height of the distribution chart. It sometimes happens that pairs of works are found which match in the shape of the distribution. These matching pairs may be works of similar length or of very different length. They may have similar ASLs or quite different ASLs. If the shapes match, then one of the variables is eliminated and a direct comparison of the relative scales of the two works may be made in terms of average sentence length.

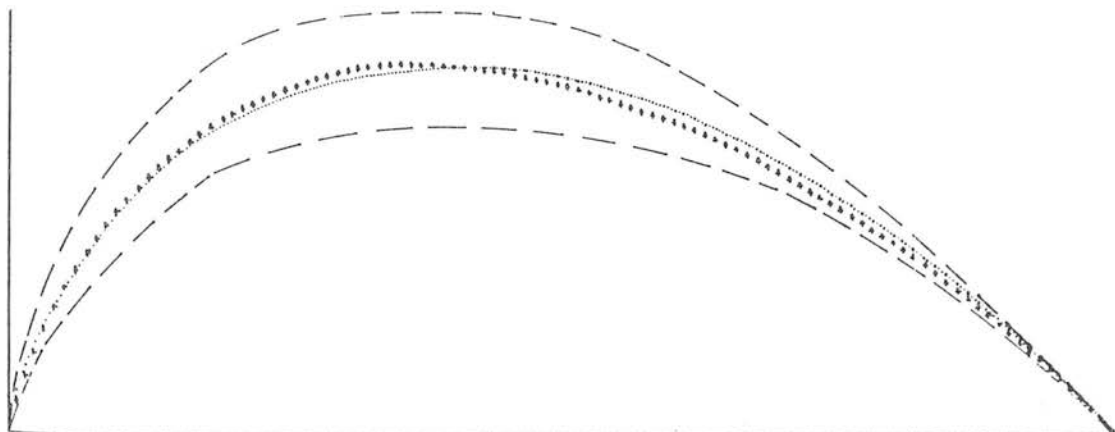
This is demonstrated, for example, in two stories by O. Henry - "*Between Rounds*" [3, p. 29] and "*Cosmopolite in a Cafe*" [3, p. 22]. They are of similar length (2058 and 2019 words respectively) but of very different average sentence length (14.00 and 21.25 words respectively). The graph on page 137 shows that the difference between the two curves is very small compared to the whole distribution range of the author. The two works have almost the same shape of distribution and so one variable may be considered



# PAIR WITH SIMILAR LENGTHS BUT DIFFERENT SCALE

AUTHOR: O. HENRY

+	+	+	+	"COSMOPOLITE IN A CAFE"	ASL: 21.25	WORDS: 2019	SENTENCES: 95
.	.	.	.	"BETWEEN ROUNDS"	ASL: 14.00	WORDS: 2058	SENTENCES: 147
— — — LIMITS OF DISTRIBUTION RANGE							



# PAIR WITH SIMILAR SCALE BUT DIFFERENT LENGTHS

AUTHOR: O. HENRY

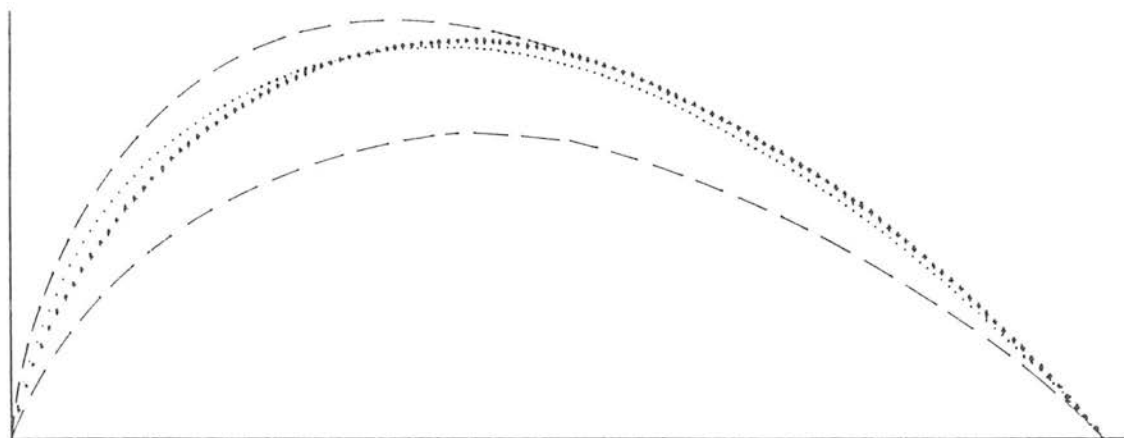
+	+	+	+	"FROM THE CABBY'S SEAT"	ASL: 16.35	WORDS: 1733	SENTENCES: 106
.	.	.	.	"HEARTS AND CROSSES"	ASL: 14.57	WORDS: 4356	SENTENCES: 299
— — — LIMITS OF DISTRIBUTION RANGE							

to be eliminated, allowing the ASLs to be used as a measure of scale. The scale of the latter story is 50% greater than that of the former. In other words, the sentence distributions are in proportion, but constructed on different scales. It may be noted that the apparatus showing horizontal and vertical scales has been omitted from the graphs on page 137 as four sets would be required. The purpose of the illustration is simply to show how close together the graphs of the two stories lie in relation to the whole distribution range of that author.

An alternative way of increasing length in short stories is demonstrated by another pair by the same author - "*From the Cabby's Seat*" [3, p. 99] and "*Hearts and Crosses*" [3, p. 143]. In the case of this pair there is only a small difference in ASL (16.35 and 14.57 words respectively) but a large difference in length (1733 and 4356 words respectively). Again the distribution curves (page 137) lie close together showing that the distributions are in proportion to each other. The differences between the curves are small in comparison to the whole distribution range of the author. In this case the longer work simply contains more sentences of a similar distribution to that found in the shorter story. This contrasts with the first pair in which each work contained a similar number of words, but in one the sentences were constructed on a larger scale than in the other.

Similar differences may be found in Greek authors. On page 139, two pairs from Isocrates are shown. The first pair, *Trapeziticus* and *Antidosis*, show substantial differences in both ASL and length, but the graphs show that the distributions are in proportion, as the curves lie close together. The scale difference is therefore measurable by the ASLs and is about 50%. This is maintained over a very large difference in length (3321 and 17,631 words respectively). The other pair (page 139), *Helen* and *Panegyricus*, are of similar scale as the curves match and the ASLs are close (40.53 and 38.80 words respectively), but are of very different length (3729 and 10825 words respectively). In this case the longer work simply contains more sentences of a similar distribution to that found in the shorter. Again, four sets of scales would be required and these have been omitted.

From these examples it is clear that an author may write a longer work by either of two methods. He may simply use more sentences of a similar distribution, or he may use sentences which are proportionately "scaled up".



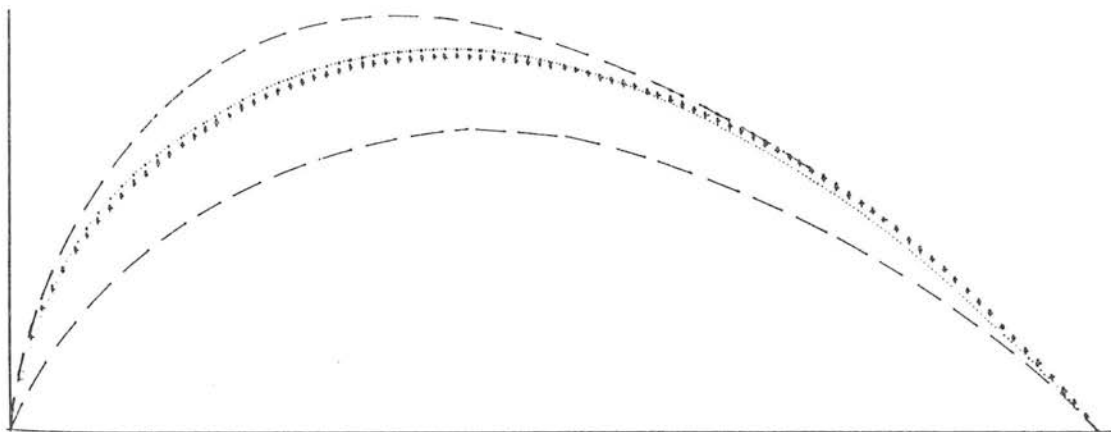
PAIR WITH SUBSTANTIAL DIFFERENCES IN BOTH LENGTH AND SCALE

AUTHOR: ISOCRATES

++++ TRAPEZITICUS ASL: 26.78 WORDS: 3321 SENTENCES: 124

.... ANTIDOSIS ASL: 39.49 WORDS: 17613 SENTENCES: 446

--- LIMITS OF DISTRIBUTION RANGE



PAIR WITH SIMILAR SCALE BUT DIFFERENT LENGTHS

AUTHOR: ISOCRATES

++++ HELEN ASL: 40.53 WORDS: 3729 SENTENCES: 92

.... PANEGYRICUS ASL: 38.80 WORDS: 10825 SENTENCES: 279

--- LIMITS OF DISTRIBUTION RANGE

It is this "scaling-up" process which allows some authors to vary the ASL very widely, both between sections of one work and between different works.

In the above argument, the term "scale" has been used in a technical sense with some care. It might be useful for practical purposes to identify scale with ASL, but that would on occasion be simplistic, because it would not take into account the differences in sentence length distribution which are found in the works of any author. Only when the distributions are in **proportion** (and that variable is therefore eliminated) is it correct to use ASL as a measure of scale. The two variables, in terms of ASL and sentence length distribution, are always present and interactive. When the sentence length distributions are in proportion, then and only then, is it proper to use ASL as a measure of scale. Scale is therefore concerned with what might be called the "texture" of the writing, rather than with the length of a work. Indeed, the scale of a work is entirely independent of its length, just as the scale of a building is entirely independent of its overall size. To illustrate this, consider that if a cathedral ten bays long were burned down and only one bay remained standing, that bay would still be on the same scale as the original building. The scale would not have changed even though the remaining portion was smaller in size. On the other hand, if a block of domestic flats was extended until it was a mile long, it would still be on a domestic scale, because the "texture" of the building which is provided by the smaller structural units like windows and doors, would still establish a domestic scale. The dimensions of sentences in a work of literature are like the windows and doors in a domestic building: they establish the scale of the work as they provide the "texture" of the text.

An author therefore has two ranges of variations in his work. Firstly there is a **range of shapes of sentence distribution** because the proportions of the various sizes of sentence may differ from work to work. Secondly, there is a **range of average sentence length**. As both of these features vary from work to work, it will be seen that it is somewhat inaccurate to speak of the range of ASL as a "scale range". ASL gives only an approximate guide in this respect and if, for practical purposes, the range of ASL is described as a "scale range", it must be realised that this is a convenient shorthand and is not a precise technical term.



## 4.2 Scale and Sentence Expansion

Anomalies were previously noted in the works of Ignatius regarding the percentage of sentences extended by the use of colons, compared with the ASLs of the letters (page 108). The letter to Polycarp has the lowest ASL but the second highest rate of extended sentences. The letter to Magnesians has the highest ASL and the lowest percentage of extended sentences.

In the samples drawn from English literature we may be reasonably confident that we have the authors' punctuation. These authors have different habits with regard to the use of colons, semicolons and parentheses. Barbara Erskine and O. Henry make occasional use of these devices in their storytelling, often to escape from more rigid grammatical constructions. James S. Stewart and I myself make occasional use of colons etc. in transcribing what is essentially the spoken form of a sermon into a written form. Sermons may be written before they are spoken, but in writing them one is trying to anticipate the situation in which they will be preached, attempting to imagine the reaction of the congregation and to phrase the text in such a way that it will not only sound spontaneous but will feel spontaneous. Success is not always achieved, and in my experience such a script may only be a starting point, and may be departed from if it interferes with living communication between preacher and congregation. John Ruskin and Thomas Carlyle developed the use of colons etc. into an art, and in so doing achieved far higher ASLs than the other authors writing in English.

One cannot tell to what extent the punctuation of works by these writers has been influenced by editorial activity, but it is clear that each of these authors has distinctive habits in punctuation, and editorial adjustment may be minimal. This is not the case with the Greek texts. Each of the versions of the Greek text is punctuated by its editor according to his own interpretation of the text, and possibly influenced by previous editors. The punctuation of the standard versions owes much to modern conventions of grammar. Many editors are tempted to introduce stops in order to make the text more readable for people accustomed to twentieth century conventions, just as translators of the Scriptures are tempted to break up the text into short sentences for the sake of clarity and easy reading. Nevertheless, the original unpunctuated text has an inherent rhythm and pattern of stops of

various weights, and punctuation is an effort to recover the inherent rhythm of the text. While there are differences in the versions of ancient Greek texts, there is a substantial measure of agreement. Most of the variations concern the choice between a full stop and a colon; less often the choice is between a colon and a comma. There is sufficient agreement to allow the use of full stop sentences to show how textual units are expanded.

The first examples showing how authors achieve greater average sentence lengths are taken from works in English. A sentence was considered to be "extended" if it contained a colon, semicolon, dashes or parentheses, and the percentage of sentences extended in this way was determined in samples from the work of several authors, as follows:

James Stewart:

<i>Why Be a Christian?</i>	ASL: 15.75	22% extended
<i>A Faith To Proclaim, Ch. 5</i>	ASL: 22.57	43% extended

This shows an increase in scale together with an increase in the percentage of sentences extended by the use of colons etc.

O. Henry:

<i>Mammon and the Archer</i>	ASL: 12.65	7% extended
<i>Cosmopolite in a Cafe</i>	ASL: 21.25	8% extended

This shows an increase in scale without a significant increase in sentence extension. Note that these two authors are covering a similar range of average sentence length, but whereas the Stewart samples show that sentences are extended by the use of colons etc., O. Henry achieves (in this case) a greater ASL by using proportionately longer sentences.

John Ruskin:

<i>Stones of Venice, Ch. 1</i>	ASL: 42.52	57% extended
<i>Lectures on Art 1</i>	ASL: 52.51	55% extended

These two are based on 100 sentence samples and the percentage extension is virtually constant. In the second sample the sentences are proportionally longer.

In the ancient Greek texts, a sentence was considered to be extended if it contained one or more colons. In the works of Isocrates there is considerable variation in his practice, but two sets of data were extracted:

SET 1	<i>Aegineticus</i>	ASL: 29.52	28.3% extended
	<i>Nicoles aut Cyprii</i>	ASL: 32.05	31.2% extended
	<i>Helen</i>	ASL: 40.53	39.1% extended

In SET 1 the percentage of sentences containing one or more colons runs parallel with the ASL. As scale is increased, so the percentage of extended sentences increases almost pro rata.

SET 2	<i>Ad Nicolem</i>	ASL: 30.99	39.2% extended
	<i>Evagoras</i>	ASL: 41.77	38.2% extended
	<i>Panathenaicus</i>	ASL: 53.58	38.3% extended

In SET 2 the percentage of extended sentences remains constant while the ASL ranges from 30.99 to 53.58 words - a differential of 73%. This indicates a change in scale without increasing the percentage of extended sentences. The increase in scale is achieved by employing longer sentences and more substantial clauses of simple construction.

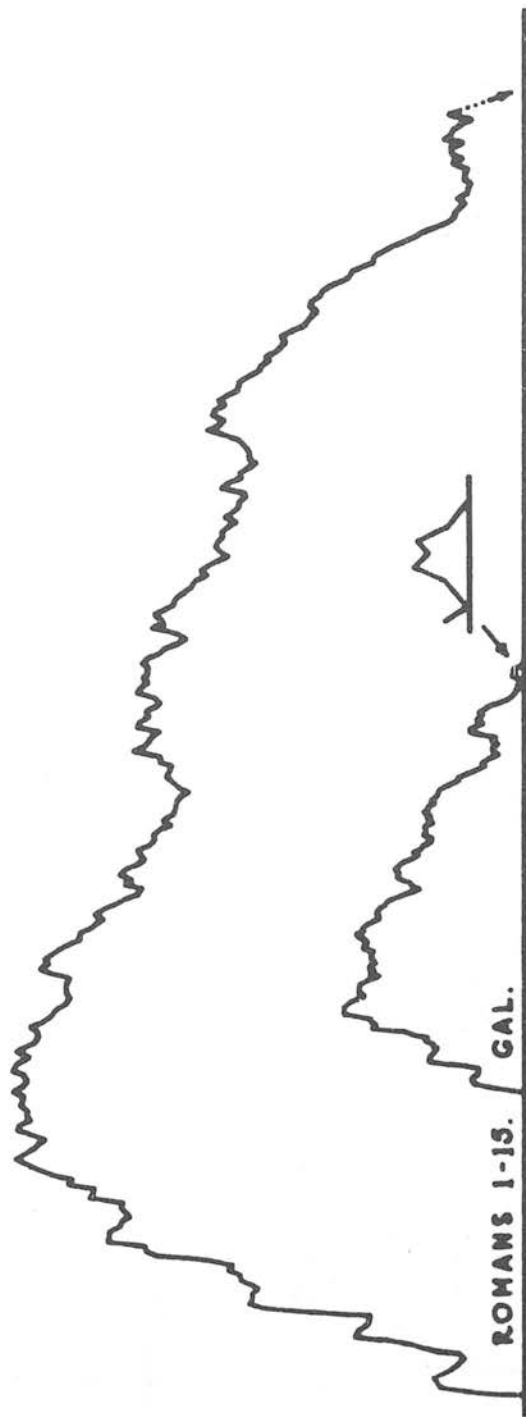
It is hardly necessary to give examples of short sentences which do have colons and long sentences which do not have colons. It is apparent, however, that an increase in scale can be achieved in both English and Greek writing, either by extending sentences through the use of colons etc., or by maintaining the percentage of extended sentences and using proportionally longer clauses and longer simple sentences to achieve a higher ASL.

### 4.3 Scale and Sentence Sequence Patterns

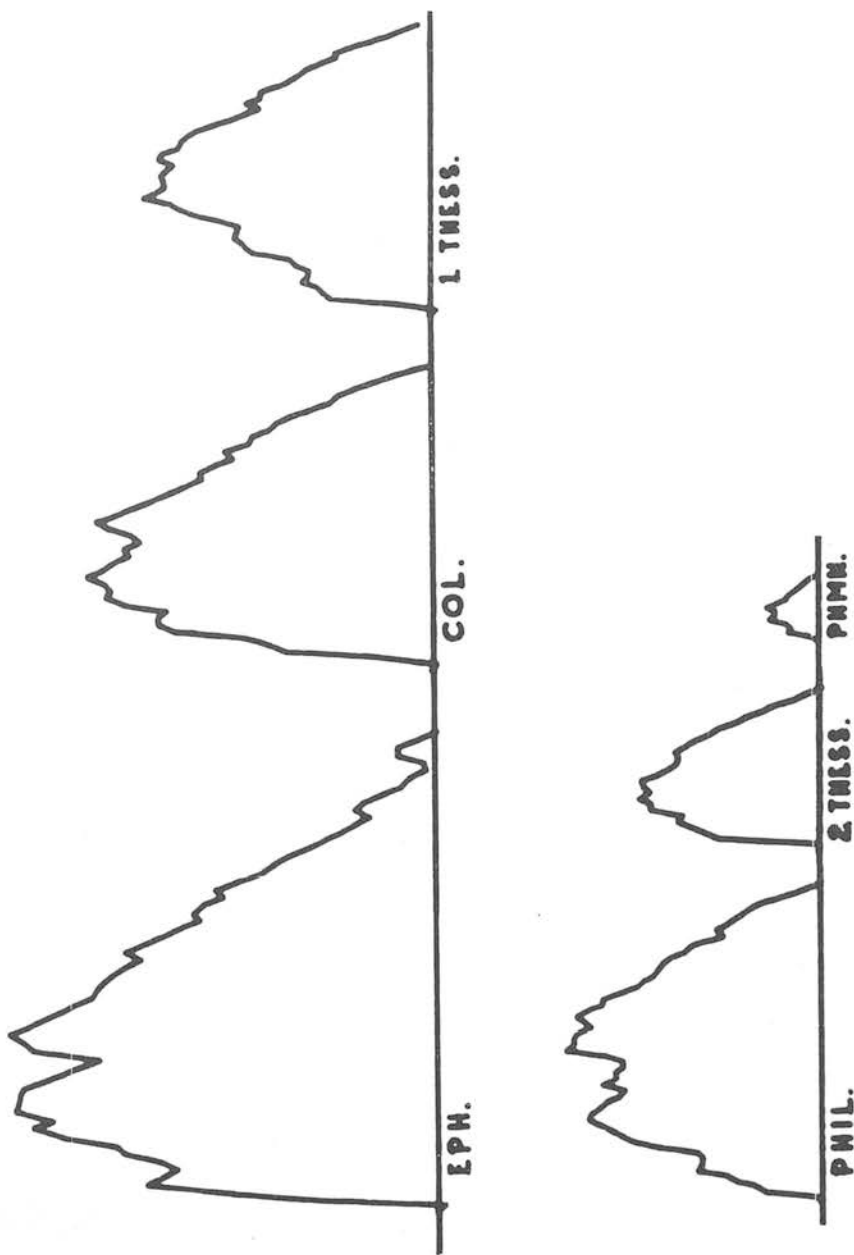
The first evidence of scaling effects in sentence sequence patterns came to light in 1965 when I drew cumulative sum graphs of the New Testament letters (see page 2). Wrestling with the problem of the punctuation of Greek texts, I carried out a subjective exercise in grouping words according to the "flow" of the text. In many cases this corresponded to the full stop sentences of the standard versions, but I often felt it was necessary to group together strings of very short questions, and to combine short exclamatory word groups with adjacent sentences. These problems are considered further in section 4.4.7 (pages 173ff.). The graphs of Romans 1-15 and Galatians which I prepared in 1965 are shown on page 145. In terms of the shape of sentence sequences, the latter appears to be a small scale version of the former. Although there are differences in detail, they have similar proportions and have some features in common, notably the "stepped" opening sequences. Each step represents a series of longer sentences followed by a series of shorter sentences.

Another group of New Testament letters seemed to share rather different proportions and characteristics. The size of these letters varied considerably. The graphs of Ephesians, Philippians, Colossians, 1 and 2 Thessalonians and Philemon, also prepared in 1965, are shown on page 146. While the punctuation at that stage was problematical, there did appear to be a scale relationship of some sort between the sentence sequence patterns of these letters.

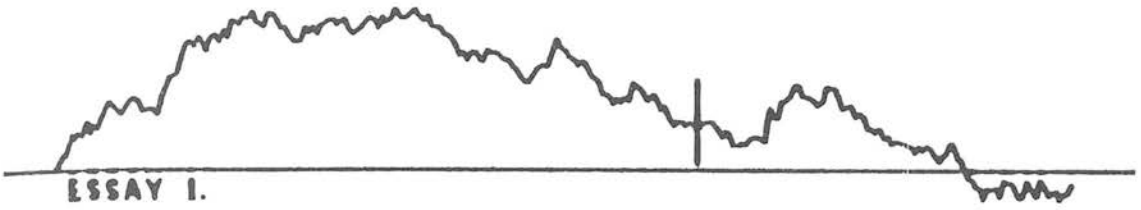
I then turned to my own student essays as I had more confidence that the punctuation of these truly reflected the flow of the text. Essay 1, shown on page 147, is a thesis on the Church in the Highlands, written when I was an architectural student in 1952. I noted with interest that it appeared to fall into two parts, the latter part being a small scale version of the first part. The division is marked on the graph. Reference to the text showed that after a brief introduction, the first part referred to the Church prior to the Reformation and the latter part referred to the post-Reformation Church. The material had been gathered together and had then been written out in two operations, as two independent essays. The brief introduction had been written last.



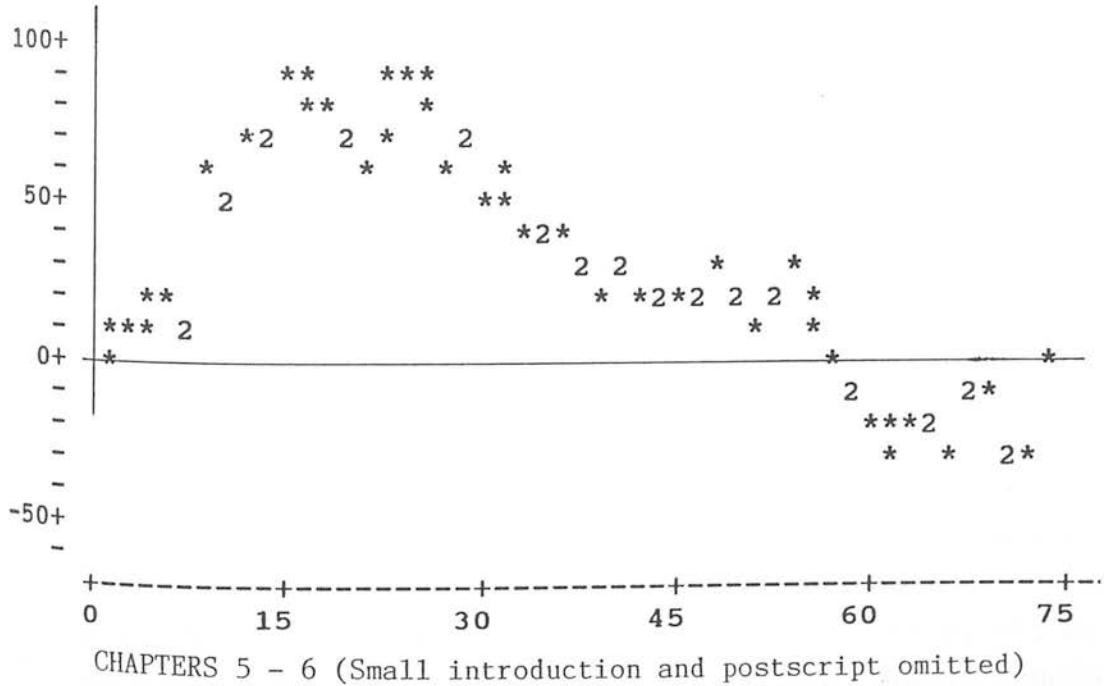
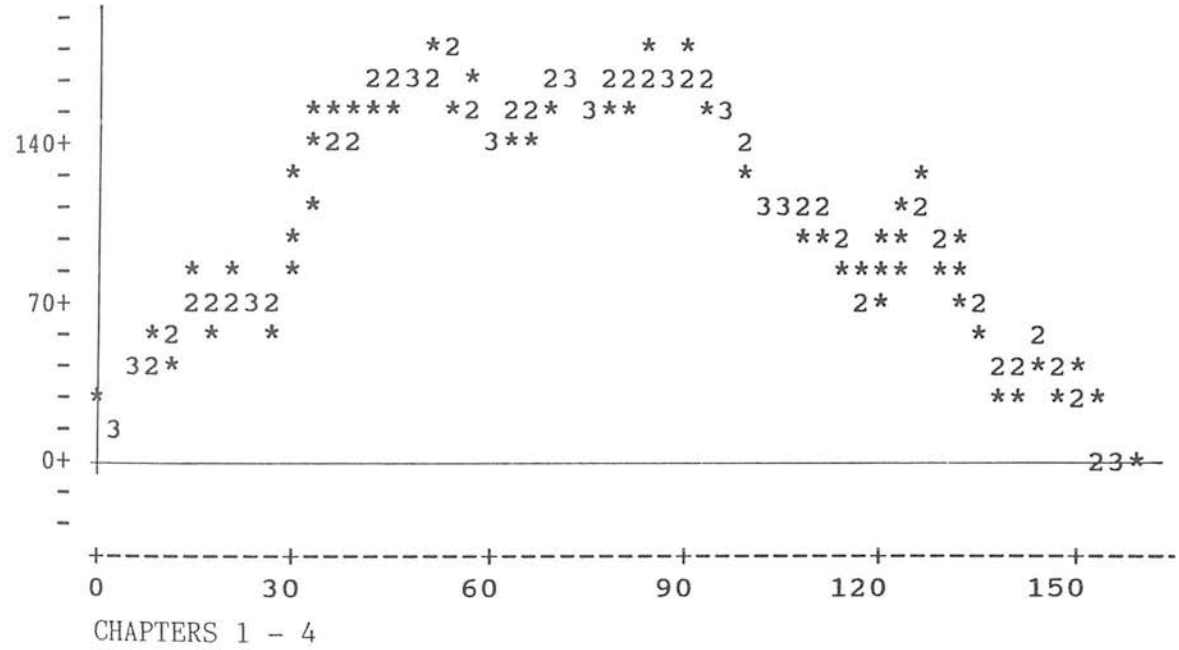
COMPARISON OF SENTENCE SEQUENCE GRAPHS - ROMANS AND GALATIANS - 1965 VERSIONS



COMPARISON OF SENTENCE SEQUENCE GRAPHS - 1965 VERSIONS  
 EPHESIANS, COLOSSIANS, 1 THESSALONIANS  
 PHILIPPIANS, 2 THESSALONIANS, PHILEMON



SENTENCE SEQUENCE GRAPH OF THESIS "THE CHURCH IN THE HIGHLANDS"  
1952

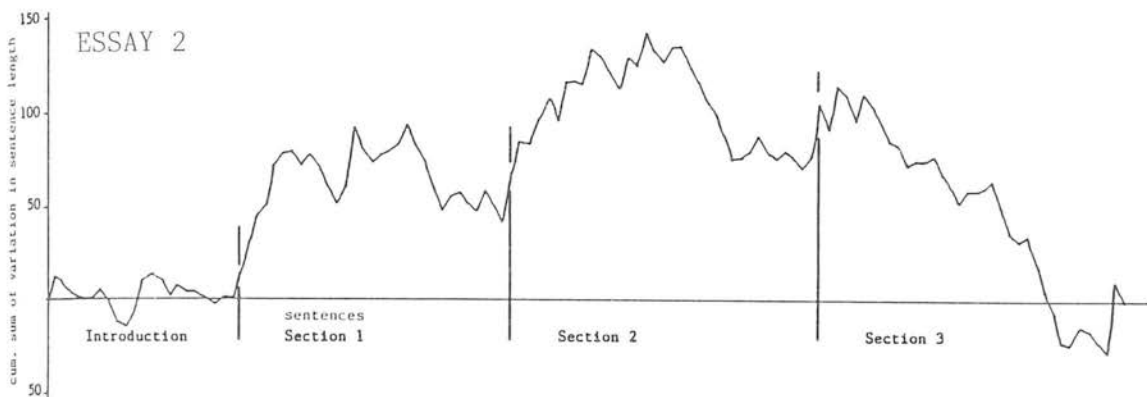




Essay 2, on page 149, was written in the Old Testament Department in Trinity College in 1964 and the graph clearly falls into four parts. Reference to the text again shows that these parts are related directly to the sections of the essay. The first part is the introduction which was written last, and which consists of sentences of average length. The other three parts have similar features. The second and third sections run parallel to each other in most respects and have similar ASLs. The fourth section has a lower ASL and has fewer long sentences, which accounts for the trace lying nearer the base line. It still shows distinct similarities to sections 2 and 3. It should be noted that similar features are not very obvious in the graph of the whole essay, and the sections have to be drawn out separately to allow these features to appear in their correct proportions.

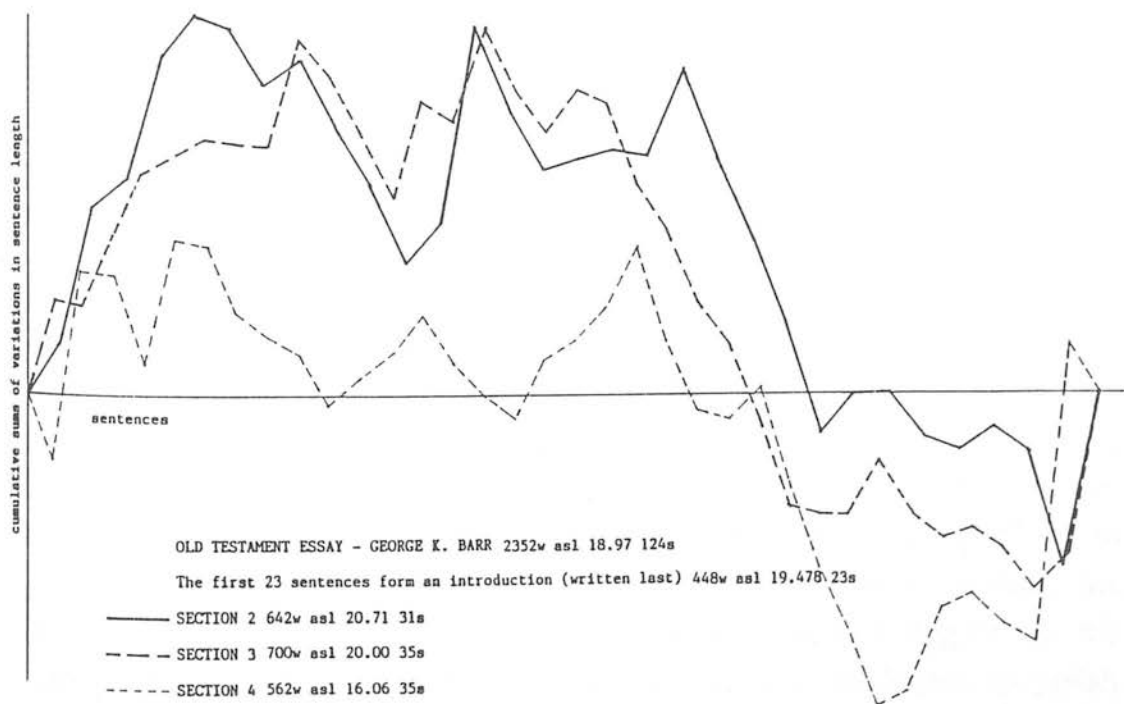
This personal history has been recounted because it led to the concept of the "prime pattern". The shapes of each section in these essays appeared to be related to material which had been thought over, marshalled in the mind and then written out in one operation. They represent "primary" material as against secondary material which has been added during the process of writing or dictation, or by another hand - hence the term "prime pattern". There is a limit to the amount of material which can be handled in this way, and in longer works it might be expected that a series of motifs should appear, rather than a single overall pattern. Such patterns do not appear in my sermon material, and I attribute this to the fact that my sermons were seldom written out in one operation, without interruption. Circumstances decreed that most sermons were prepared piecemeal through the week, and the writing was frequently interrupted by telephone calls or visitors.

There must be a limit to the quantity of material which can be held in the mind and written out in one operation. For this reason, most of the English pieces selected for study are between 1,300 and 4,000 words in length. This also gives a fair comparison with the New Testament material. The other Greek texts vary more widely, from 830 to 17,613 words. Most of the selected material lies in the 1,500-4,000 word range, as it was thought that this might allow the best chance for prime patterns to appear. The main section of Essay 1 is 3,311 words in length and is the longest pattern of this type I have found in my own work. Romans 1-14 is twice as long, and if it is a prime pattern of this kind, then it must represent something of



OLD TESTAMENT ESSAY - GEORGE K. BARR

2352 words ASL 18.97 124 sentences



a tour de force. From these early experiments, it seemed that the main question regarding the Pauline Epistles was the reconciliation of the two different types of sequence graph represented by the Romans/Galatians group and the Ephesians/Philemon group.

Further evidence for the existence of prime patterns is found in the repetition of typical motifs to different scales in James S. Stewart's work (page 151). These motifs comprise only small parts of his sermons and lectures, but point to definite forms of sentence sequences. The letters of Ignatius provide patterns extending over virtually the whole length of several works, in particular the letters to Ephesians, Smyrnaeans and Romans (page 152). There is a scale difference in these which appears as variations in ASL - 20.45, 18.47 and 14.63 words respectively.

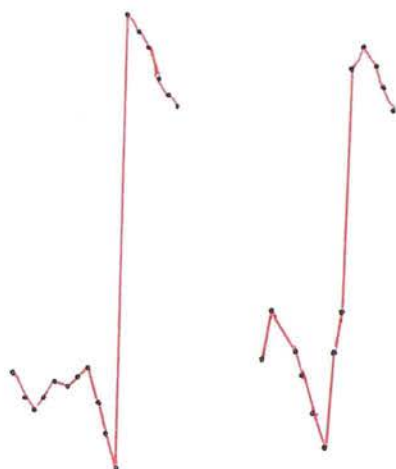
Distinctive prime patterns, it must be said, are rarely found, and much depends upon the way material is prepared. Material prepared on computer, with many alterations and insertions, is unlikely to have the strong contrasts which characterise the prime patterns so far detected. Using cut and paste methods will tend to destroy the contrasts by conflating material which has been written at different scale levels. It requires the juxtaposition of whole sections with different ASLs to produce these bold patterns. Reworking texts also tends to destroy the contrasts unless the material is entirely recast as a new piece and is moulded into a completely new form. Stories and illustrations, preserved in the memory in fixed form, and introduced into new text, may not be compatible with the scale of the context and may reduce the contrasts and damage the patterns. In my own experience, prime patterns appeared in my student essays, when I spent weeks in preparation and was thoroughly familiar with the material before committing it to paper. They do not appear in my sermon material which was more spontaneous and written against time.

If the strong patterns which are found in the sentence sequence graphs of the Pauline epistles are indeed prime patterns of this kind, then we may have reason to be grateful that circumstances made it necessary for Paul to seek the help of an amanuensis. It may be that Paul had to marshal his thoughts beforehand, and then when opportunity arose had to pour out his material in one operation, with no chance to work over the letters, to polish the text or make corrections. The graphs of his letters are characterised by

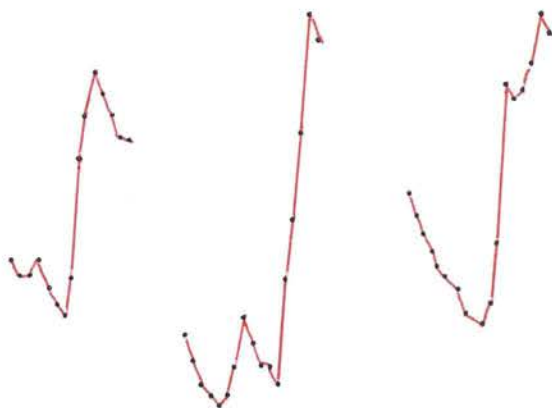
"VANGUARD AND REARGUARD"



"O MAN, GREATLY BELOVED"



"THE FINAL DOXOLOGY"



SENTENCE SEQUENCE MOTIF RELATED TO SECTIONS OF TEXT  
IN SERMONS BY JAMES S. STEWART

cumulative sum of variations in sentence length

sentences

AUTHOR: IGNATIUS OF ANTIOCH

COMPARISON OF CUMULATIVE SUM CHARTS OF SENTENCE SEQUENCES

ON STANDARD BASE

— TO EPHESIANS

— TO SMYRNA

— TO ROMANS

the most striking contrasts, often between theological and ethical sections. Frequently the boundaries of these patterns are clear, and it may therefore be possible to identify afterthoughts or added material. This will be explored in Chapter 5. Patterns also appear in 1 and 2 Peter and in Hebrews which may also be prime patterns of this kind. These will be considered in Chapter 6.

## 4.4 Scale and Text Division

In the examination of the shape of works of literature carried out in the previous sections, the punctuation of the English texts was taken as it stood. The punctuation of the Greek texts was altered on occasion, as noted in the section on Isaeus, to reduce the scatter in the graphs caused by very brief legal directions in the text, and by some very short questions and exclamations. These minor adjustments did not substantially affect the overall shape of the graph or the validity of the general comparison of the graphs of different authors' work. This section has, however, to prepare the way for a much more rigorous examination of the New Testament material, and in particular of the Pauline letters. The use of sentence length has been essential in these studies because early experiments seemed to indicate that, as in architecture, scale is expressed through the larger components of the structure rather than through the smaller (page 17).

### 4.4.1 Sentence Length

The history of the use of sentence length distribution in attempting to determine questions of authorship is reviewed in Richard W. Bailey's contribution to *Statistics and Style* [21, p. 217]. He records the first reaction to the proposal in 1889 to use sentence length to identify the work of authors, when H.A. Parker found that the method failed to discriminate between samples from Carlyle and Dr. Johnson. Parker concluded, "This goes to show, if it does not prove, that for detective purposes the method is valueless". That may have been a hasty judgement, for the graphs on pages 129-132 show that while there may be areas of overlap in the sentence distributions of different authors, there are also areas where there is clear discrimination. Yule applied sentence length analysis to *The Imitation of Christ* [21, p. 223] and concluded that sentence length statistics were not a wholly reliable indicator in matters of this sort. Kenneth J. Neumann, in *The Authenticity of the Pauline Epistles* [50, p 204] finds that sentence length, whether measured by the full stop sentence or by A.Q. Morton's modified full stop sentence, is not a reliable stylistic index. He finds that clause length gives better results and finds good indices in even smaller units. This seems to be a fairly general view among statisticians, that the smaller units behave



more normally from a statistical point of view.

Nevertheless, sentence distribution must constitute one of the most direct reflections of creativity in writing. The problem lies in the poor fit of the statistical model to the typical shape of sentence distributions. Many attempts have been made to determine mathematically the characteristics of the skewed curve of sentence length distributions. Some, like K.R. Buch in *A Note on Sentence Length as a Random Variable* [20, p.76] have suggested that taking the logarithm of the sentence length produces a better likeness to normal distribution. This may be simply a case of roughly cancelling one skew by applying a counter skew. Yule's effort to construct a model based on Poisson's law, and Herdan's attempt to apply a lognormal law, ended in failure. H.S. Sichel, in his paper, *On a Distribution Representing Sentence Length in Written Prose* [57], provides a more sophisticated formula which some sentence distributions do fit quite well. Refinements in this direction are empirical procedures which meet with some limited success in discriminating between particular sets of samples, but cannot yet be taken to provide a formula capable of being applied universally.

My exploration of this problem is given in Appendix A, where it is held that given sufficient lengths of text, all sentence distributions do conform to one family of curves which are either catenary curves or close approximations to such a curve. The asymmetrical nature of the curve persists, and the distribution curve comprises only a portion of a symmetrical parent catenary. The extent of this portion varies from work to work, and in distribution graphs the extent of the portion is reflected in the height of the curve. This, in turn, has been found to depend on the mood of the writer. Dull, monotonous writing, with little variation in sentence length, results in a low curve. Lively writing with lots of contrast between long and short sentences, produces high curves. The works of any author then, may produce a range of distribution curves with two variables; firstly in the proportions of the parent curve from which the distribution curve is derived; secondly in the percentage of the parent curve which the distribution curve comprises. Just how these are related to "normal" law is not yet clear; what is clear is that one of these variables may be affected by human feelings and responses, by the sense of the monumental, the numinous and the sublime.

Charles Muller in *Lexical Distribution Reconsidered: The Waring-Herdan*

*Formula* [49, p. 42ff] points to what may be a similar problem in combining interdependent elements in the distribution of words. He refers to Herdan's work and his conclusion that the distribution of words obeys two laws, one being the law of chance (the "normal" law), the other which he calls the "law of solidarity" which would appear to reflect a very human aspect. Muller concludes, "In consequence the frequency scale consists of interdependent elements and not of figures drawn at random". We may be faced with a similar case in sentence length distribution where only one component behaves "normally" from a statistical point of view, while another component reflects unpredictable human responses. It remains to be seen how widely the Waring-Herdan formula may be usefully applied. It is notable that none of these explorations into the nature of sentence distributions take scale into account. They are all conditioned by the limitations of statistical method which finds its best application among the smaller textual units. Scale, on the other hand, finds its clearest expression among the larger units.

#### 4.4.2 Larger Structures

Regarding the scale level at which study may be made it is worth while quoting from the paper by Dreher and Young, *Chinese Author Identification by Segment Distribution* [22, p.156]:

"As in any other pattern discrimination problem, one of the critical elements in literary identification concerns the criterion measure. Viewed from afar, two bottles may be indistinguishable to the naked eye, while at the other end of the continuum a microscopic examination of their surface might also fail to give us usable differences. In the first instance, our criteria were too gross; in the second, too fine. Just so in literary style - somewhere between the level of the individual word and the entire collection of a man's works should lie some areas that bear his unmistakable stamp and separate his expression from others."

This suggests that there are structures in the intermediate range which might have characteristics peculiar to an author, and it is indeed within the intermediate range that these present studies have revealed structures with a scale relationship to one another. This band has scarcely been explored by

statistical analysis. Little work has been done by statistical means on structures beyond the sentence level.

As Bailey shows in his survey [21], early work by Augustus de Morgan focused on word length; Mendenhall went on to consider the relative frequencies of word lengths; others considered sentence length distribution. The examination of the distribution and diversity of word types required a broad look at the whole lexicon, but did not identify larger structures. Attempts to discriminate between the structure of language itself and the peculiar habits of individual authors dealt with the frequency of occurrence of minutiae, rather than with the combination of small details into structured units. The trend was for statistical studies to become more microscopic in their approach, as words were dissected and initial syllables and word endings were selected as features to determine word-class distributions. Studies of the occurrence of archaic words, and words borrowed from other languages and cultures, were intended to reveal traits of an author which might deviate from the normal patterns inherent in the language. None of these were concerned with structures beyond that of the sentence. The definition of a sentence for statistical purposes resulted in Morton's MFSS which behaved more normally from a statistical point of view but which was otherwise scarcely defensible (pages 161ff.). The trend has been to favour smaller structural units rather than the larger because smaller units tend to display a greater degree of normality.

Bailey [21, p. 221f] very briefly points to discourse analysis by Winburne, studies in inter-sentence connection by Swieczkowski, and thematic analysis of texts using the General Inquirer dictionary which may lead to the quantitative study of *leitmotifs* (c.f. page 31) on a large scale. These point to more promising lines of enquiry, but Bailey cannot escape from the traditional lines of statistical method when he suggests that "the scholar will doubtless be led to think about not only the frequency with which the various thematic elements appear but also their dispersion and density in the texts studied..." Consideration must be given, not only to the frequency, dispersion and density of larger units, but also to their characteristic shapes and their relation to the genre and content of the texts.

Close attention in these present studies to the changes of genre within works has revealed changes of scale and intermediate structures which were

hitherto undetected. Discourse analysis is a first step in this direction, but it is essential to appreciate the physical changes in scale from section to section. The thematic analysis of texts leading to a quantitative study of *leitmotifs* would be a promising development, provided such themes were dealt with in such a manner as to show their place within the overall structure, in both physical and literary senses, and not just in statistical terms. The most distinctive aspect of these present studies might be said to be the appreciation of a hierarchy of structures within a work of literature which are scale related, and which show the relationships between the parts and the whole of a work. The consideration of structures at the intermediate level thus opens up a new field of enquiry.

#### 4.4.3 Sentence Definition

Difficulty surrounds the definition of a sentence, and Norman Macleod of the Department of English Language, University of Edinburgh, writes in a letter to me dated 5th February, 1992, which I have in my possession, of "a novelist who varies his punctuation (and sentence structure) from novel to novel, in a quite conscious way, in accordance with his overall creative aims as a novelist.....the extent of that author's sentences is, for him, an aesthetic matter." One thinks of James Joyce and his 600 word sentence and his unpunctuated passage of over 40,000 words (page 38). In examining the shape of the works of different authors in Chapter 3 the concept of sentence was expressed in purely graphic terms to give a broad picture, but it is realised that what is graphically a sentence because of the punctuation, may not be a single sentence in structural terms. Long sentences using colons and semicolons may vary widely in terms of structure. A word group bounded by colons, for example, may be a complete simple sentence in itself, or it may not even contain a verb. The transliteration of conversation presents further problems as the inherent structure of spoken language is not qualitatively identical with that of the written word. The Greek texts present further problems in that punctuation is editorial rather than authorial.

Punctuation may have several aims. Traditional grammar lays stress on the meaning of the text, and the purpose of punctuation is largely to render the meaning clear and to present it in tidy, formal structures. Text books are

concerned with present day fashions in the use of stops - fashions which have changed considerably over the last two hundred years. The present day use of commas, semicolons, colons and full stops is constantly changing and the cause of continual disagreement among grammarians. In general, punctuation is now much lighter than it was at the beginning of the 18th century. It is not bound by precise rules rigidly observed by all competent writers.

Fries [26] attempts to escape from traditional methods of grammatical study which begin with the meaning of a sentence and by parsing allocate portions of the meaning to the various parts of the sentence. He distinguishes between the structural meanings of a sentence and the lexical meanings of separate words, and studies the devices that signal structural meanings. Structural meanings are formal matters that can be described entirely in terms of form and arrangement. *Form-classes* are determined by submitting a variety of words to a series of test frames and those which are interchangeable from a structural point of view within a test frame are deemed to belong to the same class. His analysis produces four classes which are similar to nouns, verbs, adjectives and adverbs, although they do not correspond exactly. To these four classes are added fifteen small groups of *function words*. Sentences are thus analysed in terms of structural patterns without reference to the lexical meanings of words.

This approach has some attraction, in that it might remove much of the subjective element in determining the extent of sentences, but there are problems in applying such a system to Greek texts. Fries based his studies on recorded conversation, and the change of speaker was used to isolate the *utterance units* which were considered to be free, independent linguistic units. Such an utterance unit might consist of a series of several free utterances or sentences. He distinguishes between sequence sentences and those which stand first in a situation utterance unit. Certain signals tie the sequence sentences to the foregoing units: five classes of words are identified as *sequence symbols*. Fries has not based his system on continuous written prose, yet some features could be helpful in deciding the extent of sentences in the Greek texts if a similar structural system could be devised. The concept of sequence signals might allow the combination of certain sentences in the Greek texts which are each structurally complete, but which one might hesitate to combine by using colons in place of full stops. Such combinations



are sometimes desirable when the scale of the context is considered, but may be scarcely justifiable on grammatical grounds. The use of sequence signals to determine groupings of sentences would be completely objective and based solely on structural features inherent in the text. Such signals in the Greek texts would be quite different from those found in English texts. Certain aspects of Fries's work could therefore be useful, but the development of such a system is too massive a task to be included in this present study. Nevertheless, Fries provides useful ideas to be considered in future work.

Another approach to punctuation is to consider its function in conveying the character of the spoken word, whether in conversation or dictation. In reproducing speech, punctuation may be designed to give the most vivid rendering of the spoken word which lies behind the written word. Exclamation marks serve this purpose without necessarily contributing to the meaning of the structure. Norman Macleod, in his letter to me dated 5th February, 1992, makes the point that the linguistic structure of written language is not qualitatively identical to that of spoken language. This aspect may be of some importance as Paul's letters were almost entirely dictated, and it is important to give attention to the "flow" of words.

Punctuation may be influenced by the "flow" of words. In the early stages of these studies, an attempt was made to punctuate the Greek texts according to the flow as one imagined Paul dictating a letter. This was a thoroughly subjective procedure, the results of which cannot be used for purposes of research. Nevertheless, it was an instructive exercise, making one aware of the changing scale texture between sections of the text. The relationship between punctuation and scale is one that has not been considered by grammarians.

To explore the possibilities of relating punctuation to scale, experiments were made in punctuating the Greek text using minimum and maximum word groupings, taking the shorter or the longer options which the Souter text presented through full stops and colons. To some extent this was a subjective procedure and ran the risk of creating common patterns in the different letters, just as it is possible that the editors of the various versions have contributed to the formation of patterns through their punctuation. The results were clear enough to convince me that if due regard was paid to the scale texture of the work, then the scale patterns would be more consistently

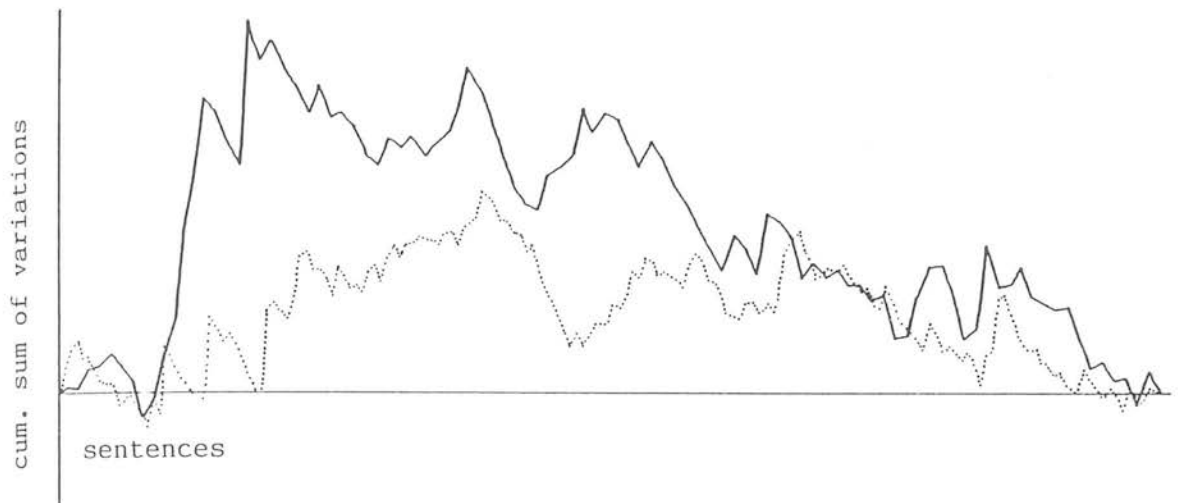
found when the longer options were taken. There appeared to be an inherent pattern in the text which was damaged or destroyed when full stop sentences were divided into smaller word groups. The experiment showed that when the Pauline letters were analysed in greater detail it would be necessary to find a logical and acceptable way of determining word groupings, so that the subjective element in the procedure was reduced to a minimum, if not eliminated altogether. The evidence that an inherent pattern in the text was damaged when full stop sentences were divided into smaller word groups required that a closer examination be made of the statisticians' approach to punctuation.

#### 4.4.4 Modified Full Stop Sentences (MFSS)

For the purposes of statistical analysis Morton adopted the "modified full stop sentence" (MFSS) by dividing the Greek text at every full stop, colon and question mark. He claimed that these smaller units were more productive, from a statistical point of view, than full stop sentences. This may give the impression of being a scientific and objective procedure; in fact it relies totally on the subjective judgement of the original editor in his interpretation of the flow of the original text according to the grammatical conventions of his time. The use of MFSS cannot escape the charge of subjectivity. Sichel also uses Morton's data based on MFSS [57].

To determine the effect of subdividing texts in this way, some tests were carried out on the works of John Ruskin who made liberal use of colons and semicolons. The distribution and sentence sequence graphs of "*The Cottage - 2*" from *The Poetry of Architecture* [6, p. 15] are shown on page 162, and those of "*The Cottage - 4*" [6, p. 33] on page 163. In both cases the distribution graphs using the modified punctuation show loss of contrast between the longer and the shorter sentences, resulting in the lower curve. The sequence graph of "*The Cottage - 2*" shows consistent loss of contrast in the subdivided version, though the trace in general follows that of the original version. In the case of the sequence graphs of "*The Cottage - 4*" it is difficult to detect any correspondence between the graph of the modified version and that of the original. Both contrast and character are lost when MFSS are employed. A complete survey of the Pauline letters was carried



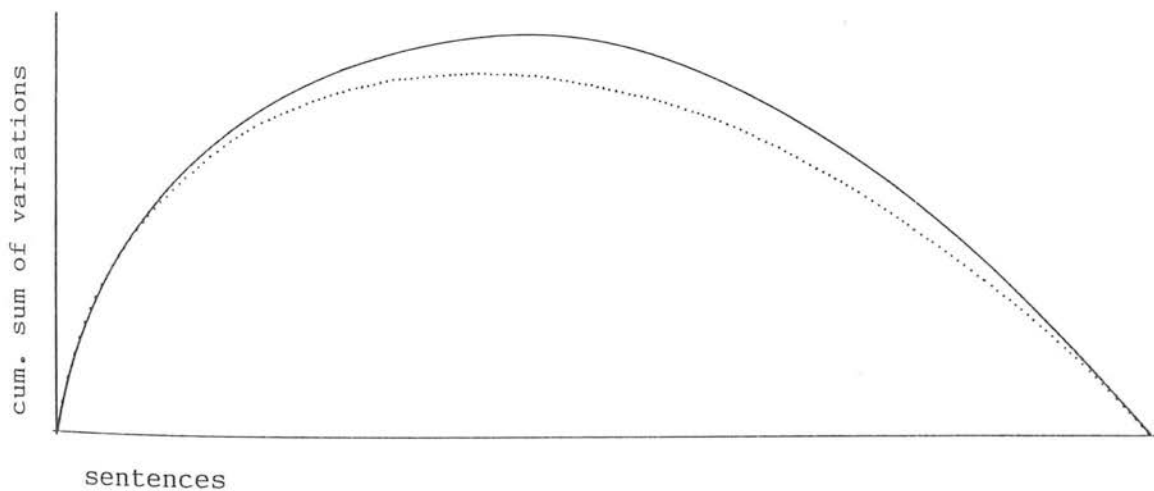


AUTHOR: JOHN RUSKIN TITLE: "THE COTTAGE" - 2

#### COMPARISON OF SENTENCE SEQUENCE GRAPHS

———— Divided at full stops. ASL: 33.86 Sentences: 97

..... Divided at colons and semicolons. ASL: 18.66 Sentences: 176

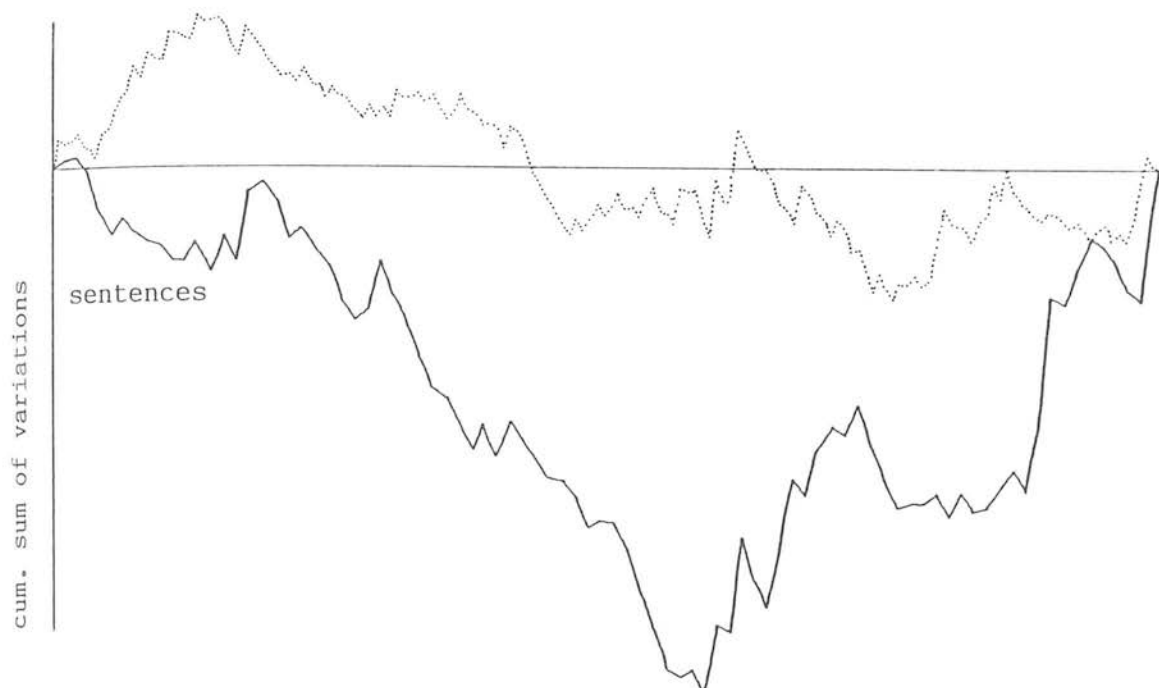


AUTHOR: JOHN RUSKIN TITLE: "THE COTTAGE" - 2

#### COMPARISON OF SENTENCE DISTRIBUTION GRAPHS

———— Divided at full stops. ASL: 33.86 Sentences: 97

..... Divided at colons and semicolons. ASL: 18.66 Sentences: 176

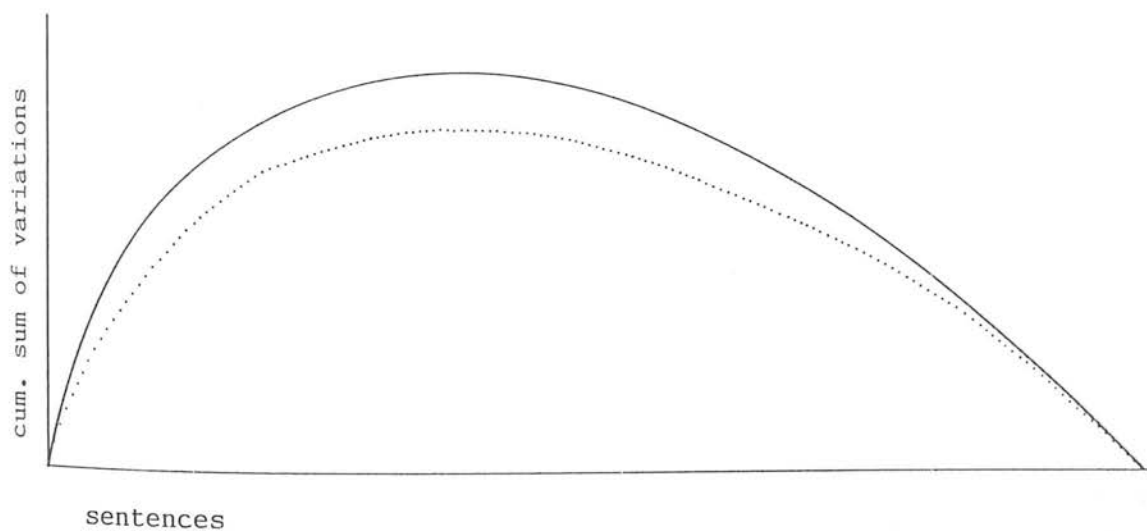


AUTHOR: JOHN RUSKIN      TITLE: "THE COTTAGE" - 4

# COMPARISON OF SENTENCE SEQUENCE GRAPHS

———— Divided at full stops. ASL: 39.57 Sentences: 86

..... Divided at colons and semicolons. ASL: 21.68 Sentences: 157



AUTHOR: JOHN RUSKIN      TITLE: "THE COTTAGE" - 4

# COMPARISON OF SENTENCE DISTRIBUTION GRAPHS

———— Divided at full stops. ASL: 39.57 Sentences: 86

..... Divided at colons and semicolons. ASL: 21.68 Sentences: 157

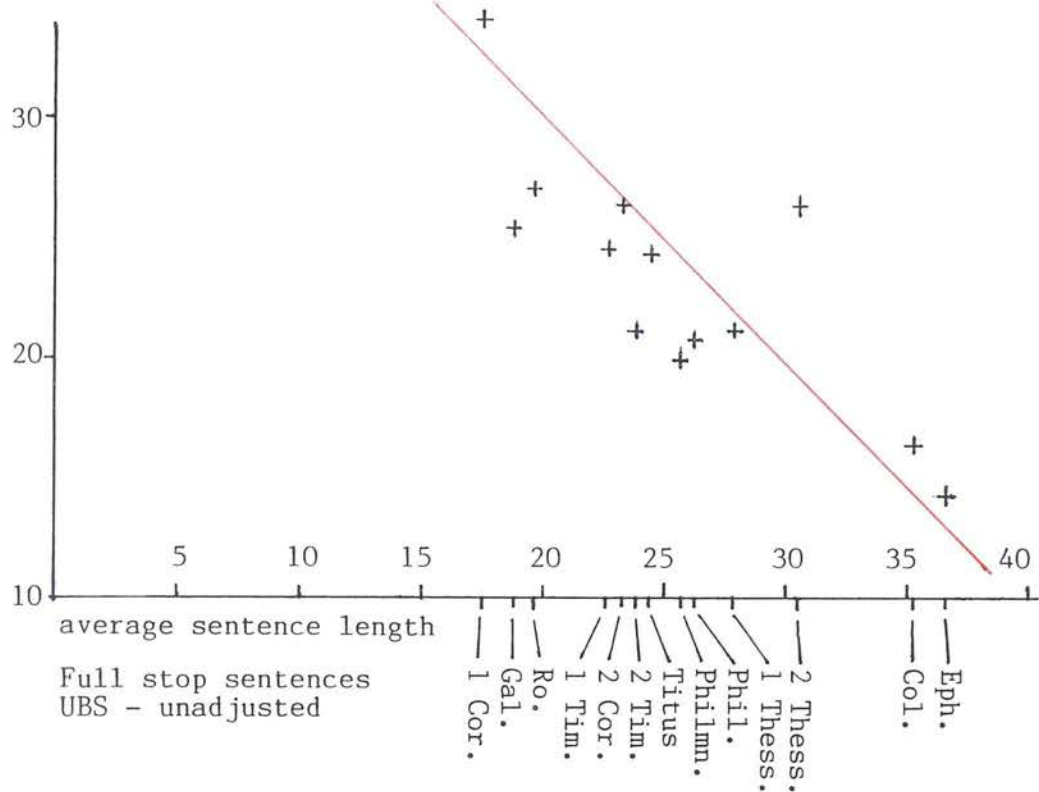
out in MFSS mode using the Friberg machine readable texts. Similar problems were found in the Greek texts, and the survey was abandoned when I concluded that the element of scale was being partially destroyed through employing this method of text division.

The use of MFSS is unsatisfactory for several reasons. As noted above, it does not escape from the subjectivity of the judgement of the editor who punctuated the text. It destroys, at least in part, the contrasts which are inherent in the flow of the text and which are a direct expression of the author's creativity. It creates a false system of stops which are all given the same value, ignoring the essential nature of a colon which is a **sign of continuity** rather than of **division**. If the editor did not intend to indicate that there was a link between the texts on either side of the colon, he would have used a full stop. There are differences in structure between short, simple sentences and long compound sentences, but there is a rationale behind these constructions which is recognisable, and which justifies the use of full stops. The truncated portions of text produced by MFSS vary in structure from verbless phrases to compound sentences and provide no such justification for the insertion of stops which are all of one major class.

They also create a false impression of scale and create new false scale ranges for each author. Scale must be respected if valid comparisons are to be made between different works. It is invalid to make comparisons between one work which consists largely of simple sentences which do reflect the original scale of the work, and another which consists of truncated word groups which do not reflect the original scale of the work. Like must be compared with like. The fact that the shorter modified sentences respond to statistical treatment more readily does not justify their use for every purpose. When a tool is inadequate for the job, one does not change the job; one looks for a better tool.

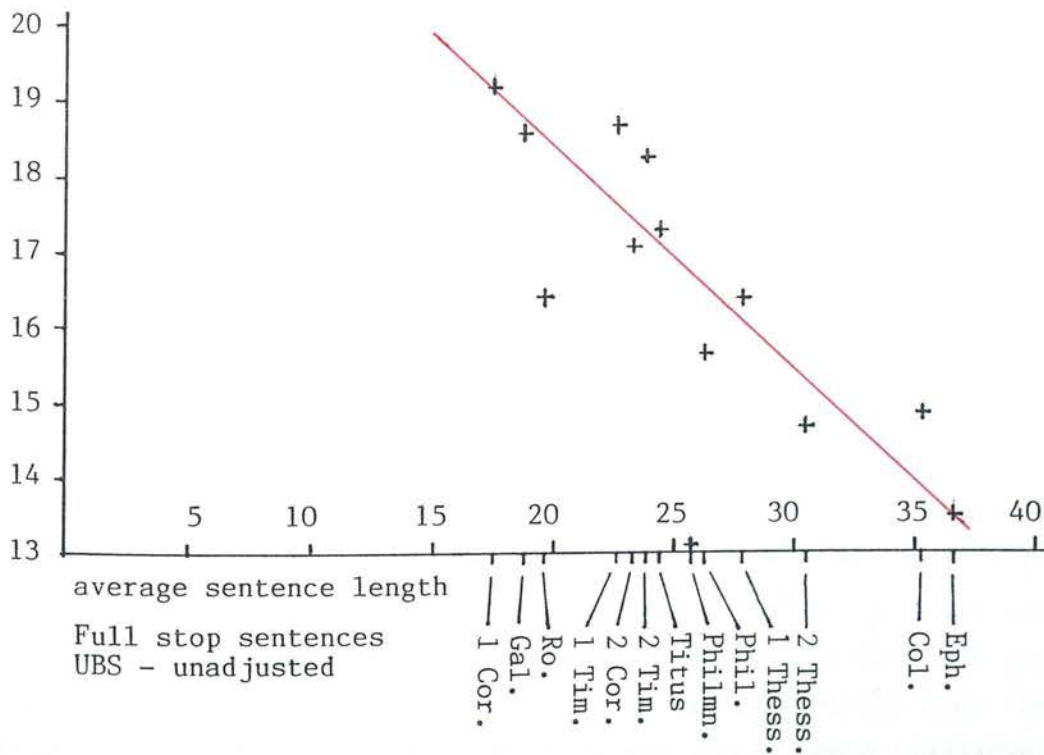
It might be thought that the problem of sentence definition would be avoided if features were assessed in terms of percentages of the whole text. Kenny [35] uses 99 features in his examination of New Testament texts, reduced to 96 features in the case of the Pauline epistles. Of these, the occurrences of verbs and of articles in the nominative, are strongly influenced by sentence length, as the graphs on page 165 show. In both cases, occurrences diminish in frequency as sentence length increases. The

Article (Nominative) %



OCCURRENCES OF ARTICLES (NOMINATIVE) RELATED TO SENTENCE LENGTH

Verbs %

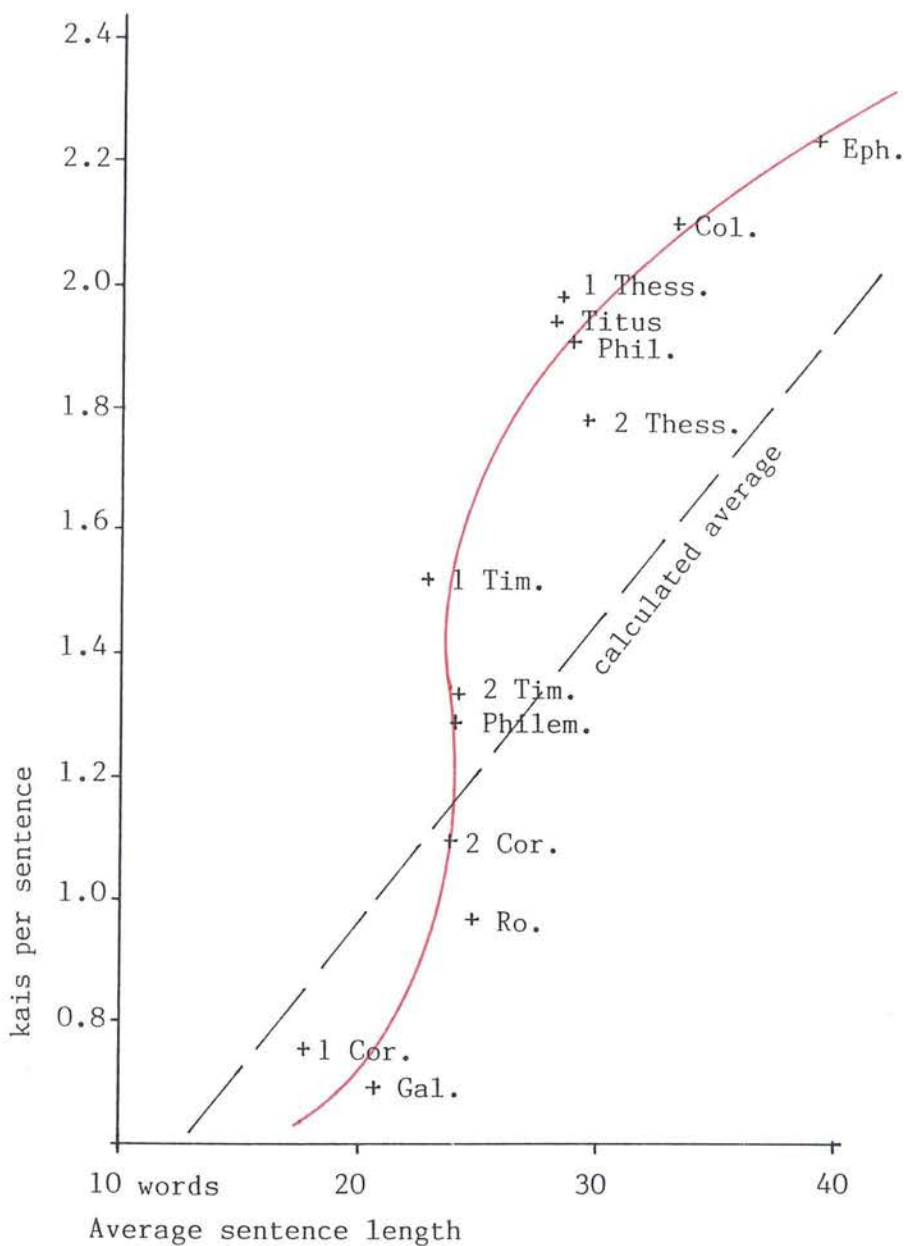


OCCURRENCES OF VERBS RELATED TO SENTENCE LENGTH

frequency of the occurrence of *καί*, on the other hand, increases along with an increase in ASL. The graph on page 167 shows how it swings from below average in letters with a low ASL to above average in letters with a high ASL. A few other features in Kenny's study show patterns which suggest that they are influenced by sentence length, but they are rather indefinite. A small element relating to average sentence length (which Kenny believes to be of very ambiguous value [35, p. 101]) is therefore included in the correlations upon which his final judgement is based.

#### 4.4.5 Text Sampling

The inherent disadvantages of MFSSs also pertain to some commonly used sampling techniques. Unless care is first taken to identify the scale level of the areas of text involved, block sampling may straddle boundaries between sections written at different scale levels. This applies to all block sampling even though different sample sizes are appropriate for different criteria depending chiefly on the frequency of occurrence in the text. A.Q. Morton, in *The Authorship of the Pauline Epistles* [47, p. 14], suggests using blocks of twenty, thirty or a thousand words. On p. 16 of the same paper he suggests that samples of 1,500 words in Greek or 4,000 words in English might be required to produce useful results by statistical methods. Ledger, in *Recounting Plato* [40, p. 5] suggests batches of a thousand words. C.B. Williams indicates in his paper *A Note on the Statistical Analysis of Sentence Length as a Criterion of Literary Style* [60, p.69] that on the occasion in question he used the words contained in each of six hundred sentences. The selection of sentences was "randomised" by taking, in one case, the first thirty sentences from each of the first twenty chapters; in the second case, the first ten in each chapter subdivision; and in the third case, the first fifteen sentences of the first forty sections. In terms of scale, this might be a far from random selection. In Chapter 3 it was shown that within the works of James S. Stewart, O. Henry, Barbara Erskine and in my own work, the shape of the sequence graphs took their form from the differences in scale and differences in ASL between adjacent sections of the text. If there are any common features in the section patterns, then choosing blocks from the beginning of each section, as Williams does, will give a highly specialised selection and not a random one.



RELATIONSHIP OF OCCURRENCE OF KAI TO AVERAGE SENTENCE LENGTH

Note: In calculating the average sentence lengths, full stop sentences were used. Strings of questions were grouped with respect to content and scale of context. The "bishops" and "Cretan" passages were omitted from 1 Timothy and Titus.

The rate of occurrence of kai increases as the average sentence length increases, but also swings from under-average in letters with a low ASL to over-average in letters with a high ASL.

The paper by Levison, Morton and Wake, *On Certain Statistical Features of the Pauline Epistles* [41, p. 135] refers to block sampling and notes that authors do tend to group long and short sentences together. It gives no indication as to why authors should do this. It does recognise that blocks should be large enough to ensure that they have random characteristics and indicates that samples should if possible be over 100 sentences in length. That would certainly not solve the problem in the case of Romans where, in the UBS text, the first 100 full stop sentences have an ASL of 23.58 words and the last 100 an ASL of 16.58 words. Not only are these two samples written at different scale levels, they are of different genre: the former sample comprising Chapters 1-7 consists largely of theological argument, while the latter, comprising Chapters 12-16 consists largely of ethical advice and greetings. Of all the Pauline epistles, only Romans and 1 and 2 Corinthians provide 100 (FSS) sentence samples and these are all severely compromised by prime patterns of substantial extent. One must question whether the statistical approach can give reliable results under these circumstances. Block sampling of this kind, which does not recognise that there are differences of scale and of genre within a work, may provide very misleading data. This is of crucial importance in the Pauline epistles where 67% of the entire text takes its form from the contrast between blocks of material of different scales and usually of different genre.

The detection of changes of scale requires much shorter samples, and the examples given throughout Chapter 3 show how these changes in scale may be precisely related to changes in mood and syntactical construction.

#### **4.4.6 Homogeneity**

The term "homogeneous" has often been very loosely used without indicating precisely the genus of the material. Blocks of material, which may be quite correctly classified under one heading, may have different characteristics in other respects. Neumann, in his multivariate studies [50], suspecting that his variables were separating different types of writing rather than authors, reduced the number of authors to "four Christian authors", but failed to ensure that there were no differences of genre within the scope of their works. "Christian writing" as a classification can hardly be considered to be



precise enough for statistical research. St. Paul's writings are "Christian writings" but one letter may contain both a theological treatise conceived on a grand scale and some ethical advice conceived on a very homely scale. It must be realised that there may be several quite different genera within a work, each with different characteristics, and it is essential, when scholars claim that works are homogeneous, that they give evidence that the works are homogeneous in respect of the particular features they are examining. Morton, in *The Authorship of the Pauline Epistles* [47, p. 13], says, "The epistles are all in the same literary form, except for the short personal note to Philemon, an epistle which is not long enough to test by this method." The classification "the same literary form" is too imprecise, and does not justify the kind of statistical examination which ignores internal differences of scale and genre.

Kenny, in *A Stylometric Study of the New Testament* [35, pp. 108f] indicates that there is a subjective element in deciding whether a two-standard-error or a three-standard-error limit should be used to provide a reasonable criterion for homogeneity. He goes on to say that "it cannot be denied that the Epistles of the Pauline corpus cannot be regarded as homogeneous in respect of sentence length". There is no doubt that the Pauline letters cover a wide range of ASL (though comparable with that of Isocrates, as the graph on page 132 shows). The range of ASLs in the Pauline corpus, using full stop sentences, runs from 36.70 words (Ephesians in UBS) to 17.24 words (1 Corinthians in UBS). This gives a ratio of 2.13 to 1. Large parts of the Corinthian correspondence are constructed in a very different way from the rest of the corpus and cannot be directly compared. If they are omitted then the letter with the next lowest ASL is Romans (19.61 words in UBS). This gives a ratio of 1.87 to 1. In comparison, Isocrates provides a ratio of 2.24:1 if *Ad Demonicum* is attributed to him, and of 2.17:1 if it is not. This is a wider range than Paul's.

The sentence sequence graphs of the Pauline epistles take their form largely from the contrast between the scales of the opening portions (often theological) and the closing portions (often ethical). The contrast between these portions in terms of ASL provides higher ratios than the greatest contrast found between whole Pauline letters. Such high ratios are easily found between sections of the works of many authors as the following show:

Paul's Letter to Ephesians provides a 1,044 word sample from the beginning of the prime pattern with an ASL of 74.57 words using full stop sentences. The closing sample of 1,024 words gives an ASL of 26.95 words. The ratio is 2.77:1 - far greater than that of the entire Pauline corpus.

The contrast between the opening portion of Romans and the closing part of the prime pattern which ends at the end of Chapter 14 provides a ratio of 1.92:1 which stands comparison with that of the whole corpus.

Philippians provides opening and closing samples of 604 and 609 words with ASLs of 46.46 and 20.3 words, giving a ratio of 2.29:1, which is well in excess of that of the whole corpus.

My sermon *Down to Earth* (page 82) provides two adjacent sections with ASLs of 31.12 words (747 words in the section) and 15.4 words (231 words in the section) giving a ratio of 2.02:1 which is almost exactly the Pauline ratio but on a rather smaller scale.

O. Henry and Barbara Erskine provide ratios of 2.44:1 and 2.43:1 (pages 88 and 91) but these contain conversation and may not provide an entirely fair comparison.

Carlyle in his essay *The World out of Clothes* (page 105) provides adjacent sections with ASLs of 46.85 words (609 words in the section) and 19.15 words (383 words in the section) providing a ratio of 2.45:1. Other adjacent sections with ASLs of 48.17 words (578 words in the section) and 18.8 words (94 words in the section) provide a ratio of 2.84:1 - much higher than the Pauline ratio. The sections with low ASL contain many questions and exclamations and are of different syntactical construction from adjacent sections.

These ratios are not found only in terms of full stop sentences. The ratio of the highest ASL to the lowest in the Pauline epistles, using Morton's MFSSs for the texts covered in the table on page 104 of Kenny's book [35], is 2.25:1 (Ephesians at 24.3 words and 1 Corinthians at 10.8 words). If 1 Corinthians is excluded for the reasons suggested above, the ratio drops to 1.97:1 (Ephesians at 24.3 words and Romans at 12.3 words). The Friberg and Friberg text has been used in this study to give a comparison using

MFSSs. The punctuation differs from the text used by Morton and falls between a full stop interpretation and Morton's MFSS rendering. It will serve to give some examples. The table on page 172 shows that Ephesians, Philippians, Colossians, 1 and 2 Thessalonians all provide substantial portions at the beginning and at the ending of their texts with ASL ratios exceeding the largest found between works in the Pauline corpus. If the Pauline corpus cannot be regarded as homogeneous in respect of sentence length then none of these letters can be regarded as homogeneous. Morton distinguishes between statistical homogeneity and literary homogeneity, but on statistical grounds comes to the conclusion that it requires several authors to account for the Pauline corpus. If that is so, then it would require different authors to write the opening portions and the closing portions of all these letters.

Which is absurd.

It might be held that these samples are too small, and that the arbitrary 100 sentence minimum must be used to achieve significant results. That standard was not possible in the analysis of the Pauline corpus which occasioned Kenny's comment that the Pauline epistles cannot be considered to be homogeneous in respect of sentence length. The impossibility of meeting the 100 sentence standard indicates the limitations of statistical theory when applied to the Pauline epistles.

The ASL ratios quoted above regarding the Pauline epistles are derived from a consistent pattern which runs right through the Pauline corpus and which is not found in the other Greek authors included in this study. This pattern is examined in detail in Chapter 5. These figures point to the importance of recognising that substantial changes of scale occur within pieces which are certainly written by one author, and which must be considered "homogeneous" in terms of authorship, whether or not they conform to the criteria selected by statisticians. It is clear that in arriving at his conclusion that "on the basis of the evidence in this chapter for my part I see no reason to reject the hypothesis that twelve of the Pauline epistles are the work of a single, unusually versatile author" [35, p. 100], Kenny was allowing other considerations to take precedence over the current statistical standard for determining homogeneity.

DIFFERENCES IN AVERAGE SENTENCE LENGTH BETWEEN EPISTLES IN THE PAULINE CORPUS  
COMPARED WITH DIFFERENCES BETWEEN SECTIONS OF INDIVIDUAL LETTERS  
USING FRIBERG & FRIBERG TEXT AND MODIFIED FULL STOP SENTENCES

Ratio of ASLs between Ephesians and 1 Corinthians, using Morton's MFSS:

Ephesians - 24.3 words. 1 Corinthians - 10.8 words. RATIO: 2.25:1  
 OR Ephesians - 24.3 words. Romans - 12.3 words. RATIO: 1.98:1

(Using FSS the ratios are 2.13:1 and 1.87:1 respectively)

Ratios of blocks within the letters using MFSS and Friberg & Friberg text:

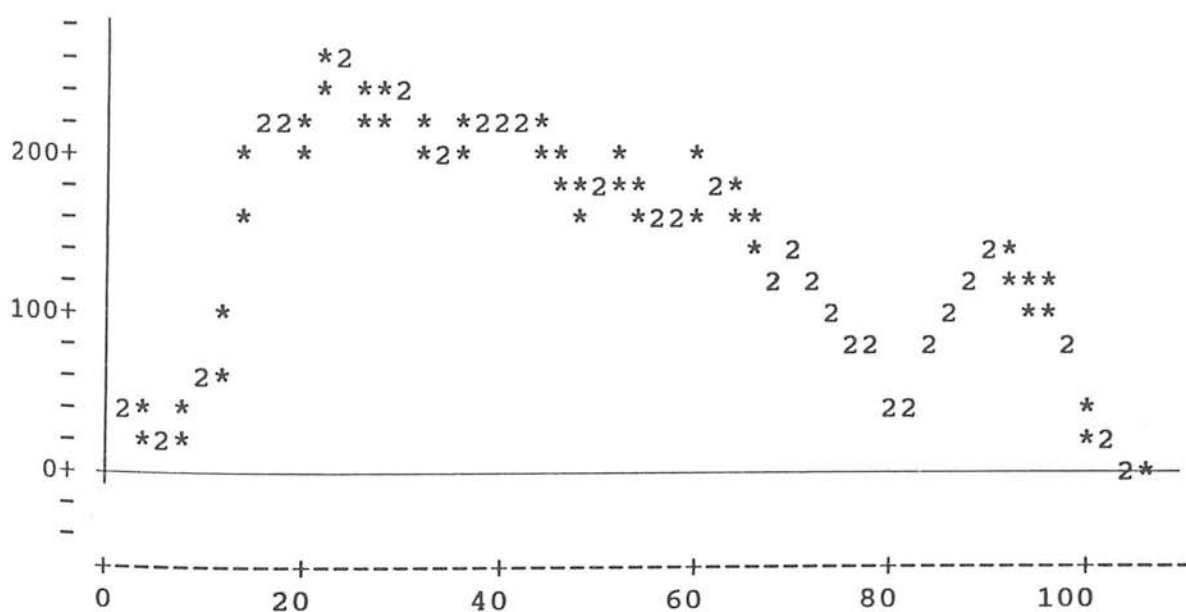
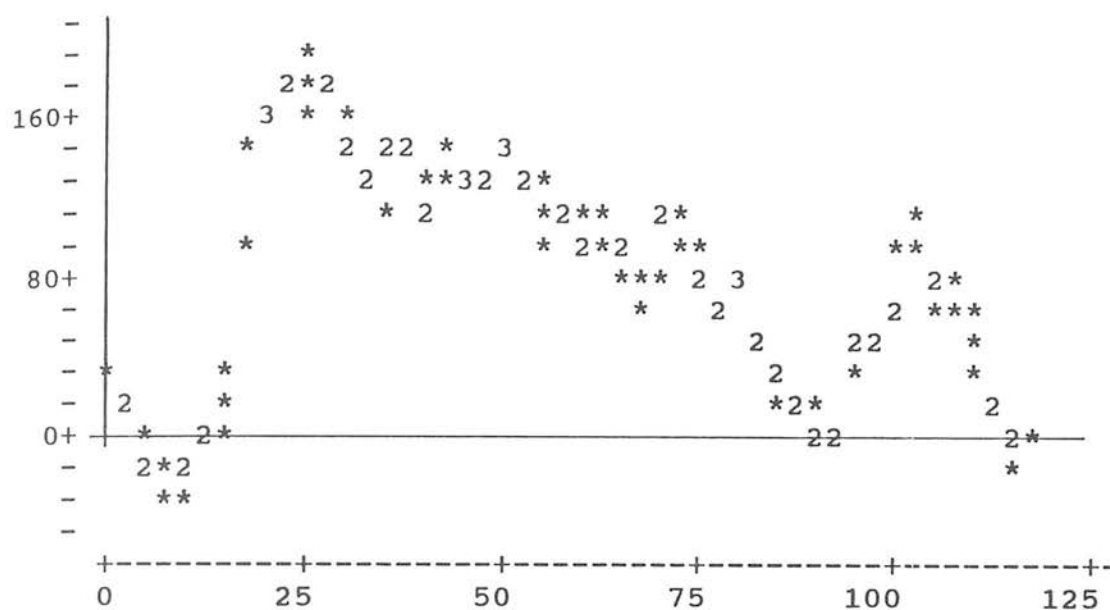
Ephesians 1:1 - 3:19	1052 words	ASL 43.83	RATIO: 2.23:1
4:25 - 6:4	628 words	ASL 19.62	
Philippians 1:1 - 2:16	733 words	ASL 27.15	RATIO: 2.01:1
3:13 - 4:23	500 words	ASL 13.51	
Colossians 1:1 - 2:4	602 words	ASL 37.62	RATIO: 2.24:1
3:1 - 4:18	656 words	ASL 16.82	
1 Thess. 1:1 - 2:16a	527 words	ASL 35.13	RATIO: 2.26:1
4:7 - 5:28	529 words	ASL 15.56	
2 Thess. 1:1 - 2:17	576 words	ASL 33.82	RATIO: 2.47:1
3:1 - 3:18	247 words	ASL 13.72	

#### 4.4.7 Questions, Quotations, Glosses and Lists

It was noted in section 3.9 (page 121) that in preparing cumulative sum graphs of the speeches of Isaeus it was necessary to combine some very brief legal directions with the adjoining sentences. Single words, like Amen and Hallelujah and very short sentences of one or two words, exercise an undue influence on cumulative sum graphs. If, for example, the ASL is 50 words, then the variation resulting from a solitary Amen is minus 49, which appears as a sudden drop in the graph. The effect of dealing with the short legal instructions in one of the Isaeus speeches is shown on page 174. If the instructions are considered to be an essential part of the pattern then the upper graph will be used. If the interest is in the underlying structure of the speech then the lower graph will display this without the effect of the short instructions. In preparing graphs of the New Testament texts I have combined one word sentences with the adjoining sentence.

Questions pose a greater problem because Paul has a habit of introducing strings of questions into his text. It is noticeable that it is when he is on the defensive that he hurls strings of questions at his accusers. These questions, taken individually, are not in scale with their context, and it is necessary and logical to group them, giving due consideration to both the content (which often suggests a grouping) and the scale of the context. Single questions may or may not be related to their context in a structural way, but where a question forms a couplet with an adjoining sentence, it is reasonable to treat the interrogation mark as a colon, rather than as a full stop. In Chapters 5 and 6 lists are given which show precisely how each question has been dealt with.

Quotations may also affect the cumulative sum graph if they have been part of a text conceived at a different scale level. Kenny examines the effect of quotations in his *Stylometric Study of the New Testament* [35, p. 120] and concludes that for statistical purposes verbatim quotes should be excluded, and that it may be assumed that other quotes have been absorbed into the text. The purpose of this present study is to take a very broad look at the shapes of whole works, and no attempt is made to abstract minutiae from the smallest textual units. Quotations therefore pose less of a problem than they



do in statistical studies. In the Pauline epistles, many quotations are absorbed into the text and may be treated as part of the text. If a verbatim quotation is in scale with its context, it has a negligible effect on the graph. Only if the quotation is verbatim, and either very long or very short in relation to the ASL of its context, is it likely to have any significant effect on the graph. Notes are given in Chapters 5 and 6 wherever a quotation has been linked with the adjoining text. The problem appears in its most severe form in Hebrews Chapter 1 (pages 288-291) where the disturbance in the graph has been noted, but no attempt has been made to alter the quotations.

Small glosses may be not be detected by the methods used in this study, especially if they are close in length to the ASL of the context. In Chapter 5 it will be seen that a distinction is made between "prime patterns" which are considered to be related to the material which has been prepared prior to dictation, and "afterthoughts" which refer to material added during the process of dictation or later by another hand. The afterthought pattern may not indicate the source of the afterthought: it merely distinguishes between the patterns of text. Sizeable blocks of material are identified in the "Bishops" and "Cretan" passages in 1 Timothy (page 265) and Titus (page 272) which may be classified as "afterthoughts". Apart from these, little scope for sizeable glosses has been found in the Pauline epistles, but further consideration has been given in the case of Galatians (pages 243ff.).

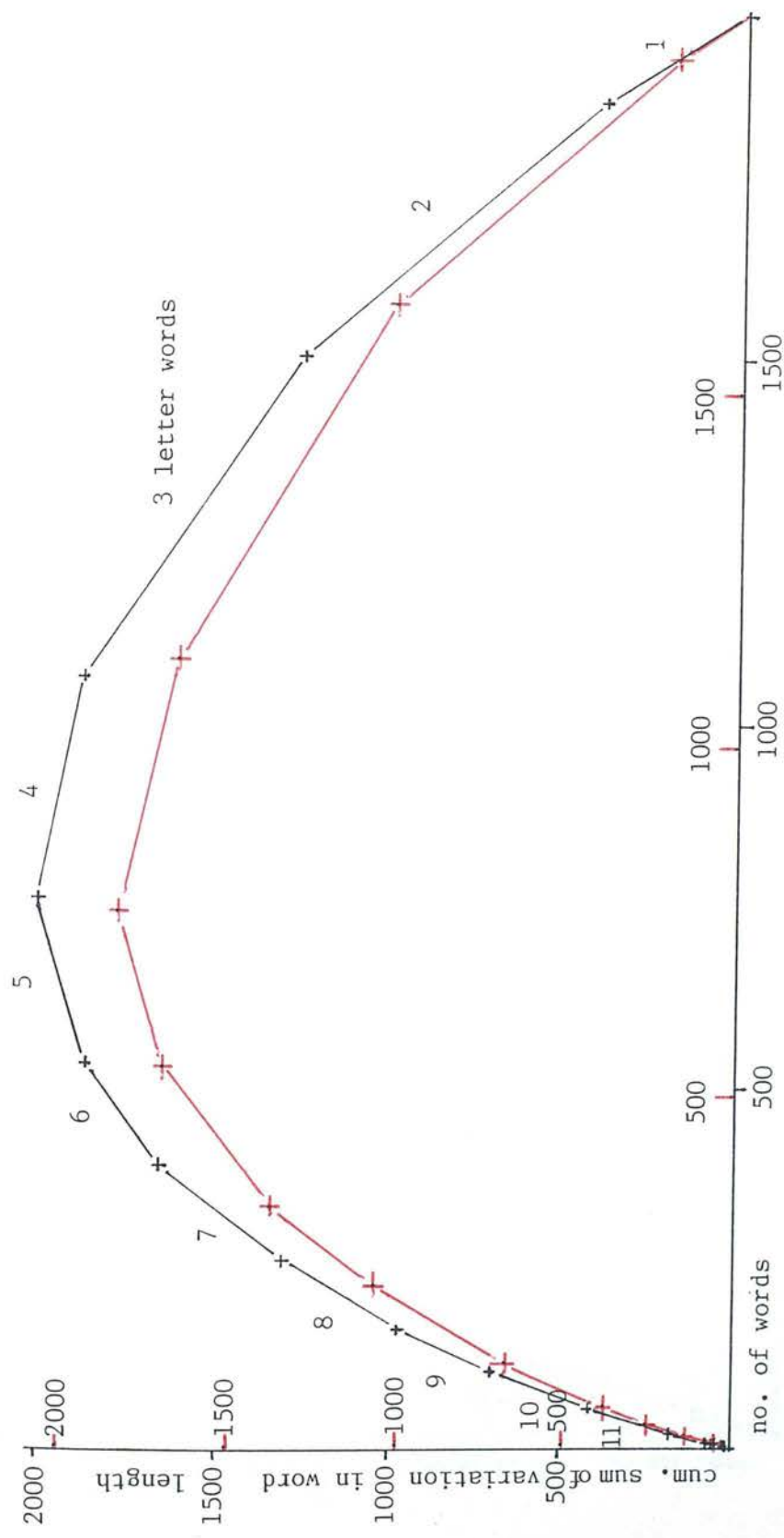
Lists may also provide long sentences which are out of scale with their context, and which may affect the cumulative sum graph unduly. These may either be noted and left as they stand, or alternatively may be subdivided, giving due consideration to both the content and the scale of the context.



## 4.5 Scale and Word Distribution

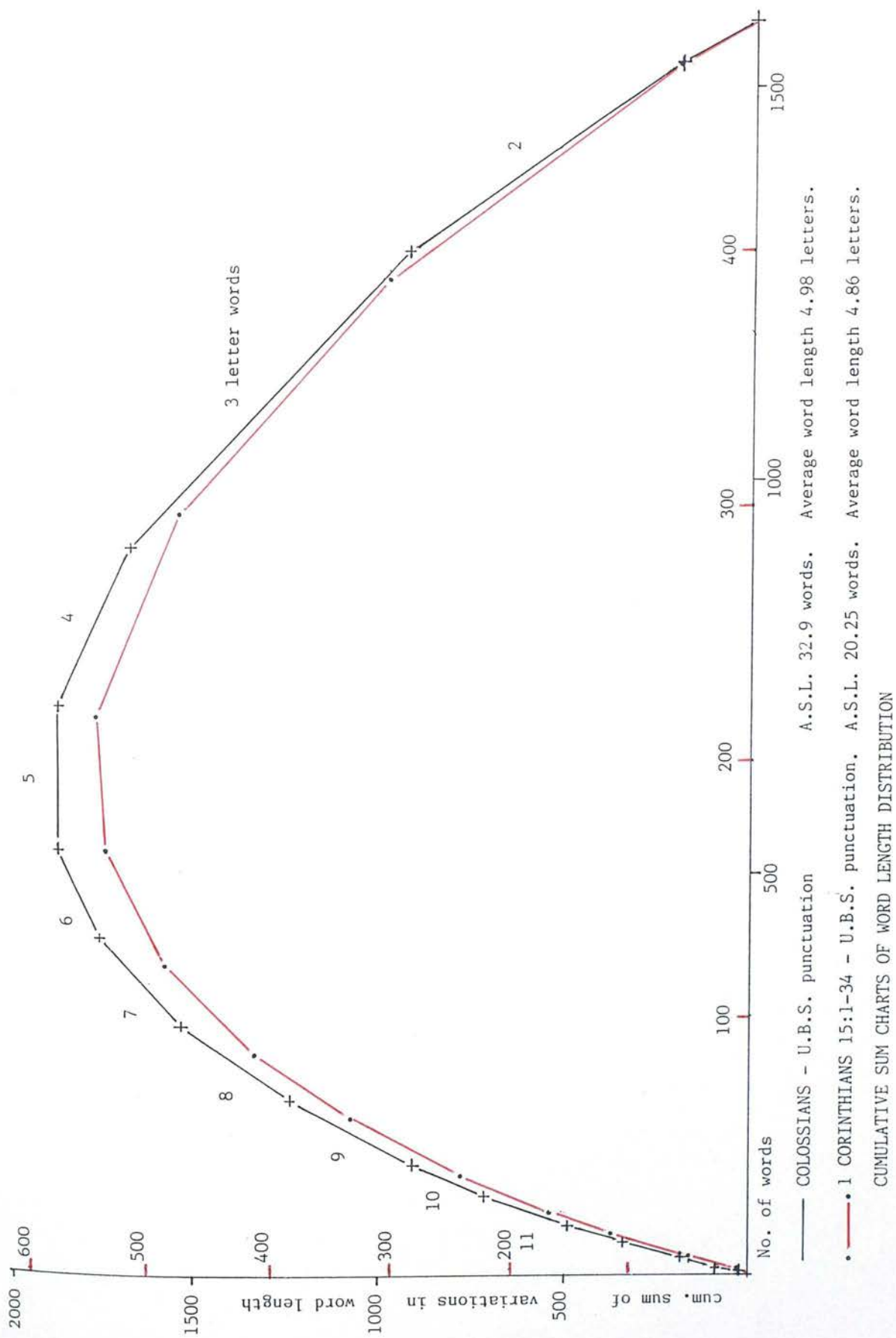
These studies have been based largely upon sentence length, and it has been found that scale patterns are most distinctive when larger textual units are used. To determine whether scale appears significantly when smaller divisions of the text are employed, two pairs of works were selected which have particular scale relationships, and the word distributions were compared. Tables showing percentages for words of different lengths are not very satisfactory as a shortage of four letter words may be compensated for by an increase in the number of three and five letter words. This is not readily appreciated when the data are in table form. Cumulative sum graphs were therefore prepared, plotting the cumulative sum of variations in word length against word units. These are shown on pages 177 and 178, and the relationships between words of all lengths is demonstrated. The comparative shortage of 3-letter words in 1 Corinthians (page 178) is seen to be balanced by a greater proportion of 2-letter and 4-letter words. Each facet of the curve represents the number of words of a particular length, and the height of the curve gives an indication of the degree of contrast between the longer and the shorter words. For this test care was taken to use whole works in order to avoid taking samples which might be affected by local variations of scale within the work. For example, a sample of 100 sentences taken from the beginning of Paul's letter to Romans would provide material on a very different scale from that of a similar sample taken from the end of the letter. Full stop sentences were used to avoid the problems inherent in the use of MFSSs noted in section 4.4.4.

The first pair from O. Henry's short stories ("*Cosmopolite in a Cafe*" [3, p. 22] and "*Between Rounds*" [3, p. 29] ) have sentence distributions which are in proportion to one another while their ASLs are 21.25 words and 14 words respectively. They are similar in length (2019 and 2058 words ) but there is a 52% difference in scale. Care has to be taken to ensure that results are not unduly influenced by vocabulary which is specifically related to the sample. In the case of "*Cosmopolite in a Cafe*" the word "cosmopolite" and associated words might have caused an increase in average word length. When eleven such occurrences are removed, the average word length drops



— 0. HENRY - "COSMOPOLITE IN A CAFE" ASL: 21.25 words. Average word length 4.41 letters.  
 (4.37 adjusted)  
 — 0. HENRY - "BETWEEN ROUNDS" ASL: 14.00 words. Average word length 4.36 letters.

CUMULATIVE SUM CHARTS OF WORD DISTRIBUTION



from 4.41 to 4.37 letters. This compares with 4.36 letters for the other story. In this case, scale differences are not reflected in word length. Although the average word lengths are very similar, the graphs show decided differences. The first story has a greater degree of contrast between the longer and the shorter words, resulting in a higher curve.

The other two (the whole of Colossians and a small but complete prime pattern found in 1 Corinthians 15:1-34) provide sentence sequence graphs which are in proportion to each other. There is a considerable difference in scale, the ASLs being 32.9 and 20.25 words respectively. There is also a considerable difference in length - 1582 and 486 words respectively. The average word lengths are 4.98 and 4.86 words: these again do not reflect the scale difference. There is little difference in the degree of contrast between the longer and the shorter words, but Colossians, being much longer, has the chance to show a rather richer vocabulary.

Figures for word length in New Testament letters were kindly supplied by Dr. David Mealand, University of Edinburgh. No pattern showing a clear relationship between word length and scale emerges. The Pauline epistles from Romans to Galatians, together with Ephesians and Colossians, form one group, with sample values ranging from 4.7 letters to 5.1 letters. The Pastorals, the Petrine letters and Hebrews form a second group with values ranging from 5.3 to 5.7 letters. These different groups are not related to ASL and it may be concluded that scale is not generally reflected in word length.

## 4.6 Scale and Time

When it is considered that an infant begins by uttering single words, and then progresses to stringing a few words together like "Daddy - window - see", it is clear that there must be some kind of relationship between ASL and chronology. Yet in a remarkably short space of time, young children learn to use constructions in the spoken word, which if translated into written form, would reasonably require the use of colons and semicolons, parentheses and dashes. Some people, who use such implicit constructions in speech, never learn to translate them into written form. Instead, they recast their thoughts into the form of simpler sentences as they write.

Morton suggests [47, p. 13] that consistency in the form of a style may be achieved over periods of up to forty years, and points out that the Pauline epistles were probably written within about 15 years, well within that limit. In *Things Ain't What They Used to Be* [48] he examines the chronological changes in the factors that contribute to style in Greek writers. Kenny [35, p. 110] suggests light-heartedly that, as he grew older, Paul may have become fonder of writing longer sentences, and that a chronological order in the writing of his epistles might coincide with the growth in ASL. This cannot be taken to be a serious suggestion as his sequence conflicts with the likely historical order of the epistles.

The authors whose work has been used in this study, wrote over periods which vary greatly in length. Ruskin wrote over a period of 50 years. He used long sentences and had mastered the art of punctuation by the time his first works were published. O. Henry (William Sydney Porter) died at the age of 43, and wrote his stories within a period of about 14 years. My own sermons were written over a period of twenty years. Isocrates wrote his last work when in his nineties. It is clear that there is a development in the work of Isocrates, as his early works, which he later considered to be unworthy, had ASLs of between 24 and 30 words, and his last work, *Panathenaicus*, had the extraordinary ASL of over 53 words. This may indicate a mastery of scale - or the ramblings of an old man. Between the years 390-342 B.C. the ASL of his works varied between 30 and 44 words with considerable fluctuation: there is no clear progression. Ruskin, within the year of 1837, had works published with ASLs which covered a

substantial part of his ultimate range. In my own case, the ASLs of sermons were fairly average for much of the twenty years, but in 1989 they provide in one year a variety of ASLs which embraces my entire scale range, perhaps indicating that towards the end of a ministry, my sermons became less laboured and showed rather more vitality.

The relationship between chronology and scale is a very loose one, and as time passes, the chronological element involved in learning to use extended forms, is taken over by the requirements of scale. Fluency in a given subject may be of greater importance than the time element. The similarity of the sentence sequences of the prime patterns in Galatians and Romans, Colossians and Ephesians, suggests that the first of each of these pairs is the earlier work of the pair, and that the second is later in date and written with greater fluency. The sentence sequence graphs of Colossians and Ephesians, in particular, show a scaling relationship - one is a small scale version of the other. The placing of the common material within each letter is, however, quite different: sections on husbands, wives, slaves etc. occupy quite different portions of the graphs (page 252) and an alternative interpretation is suggested later in Chapter 5 (page 251).

Fluency is not only a matter of familiarity with the subject: it may also be affected by physical characteristics. I have wondered whether the pattern of long sentences followed by a series of short sentences, which is typical of the opening sections of the Pauline epistles, may not be an indication of Paul's lung capacity, rather than a feature of literary style. The dictation of the opening section of Ephesians must have left him out of breath, requiring a few short sentences to regain equilibrium. Someone unused to public speaking and not accustomed to projecting the voice to fill a large hall, may be driven to the use of short sentences to allow opportunity to replenish the lungs. There is no reason why such physical requirements should affect written work, but habits developed in speech may persist in the written word.

Fluency, or the ability to produce work which "flows" without hindrance, demands a kind of vision - the ability to foresee in the mind, the shape of the whole sentence even as it is begun. Alternatively, it demands experience in expressing oneself in public, so that the form of the sentence can be adjusted even as it is being uttered - adjusted to a form which can be concluded grammatically at will. The inexperienced speaker, who has little



fluency, will be forced into using short, controllable sentences to avoid becoming trapped in long, involved sentences which he is unable to conclude tidily and grammatically. Familiarity with the subject contributes to fluency, allowing the free flow of words and ideas, punctuation becoming instinctive and unobtrusive. Someone "thinking on his feet" may fall into a convoluted style, and may find difficulty in ending long sentences grammatically. Sentence length may therefore vary considerably in the speech and writing of one person, depending on physical characteristics, health, his mastery of the situation (Paul, under attack, takes refuge in strings of short questions), experience in formulating sentences, familiarity with subject matter etc.

It may also vary with circumstances. When Malcolm Rifkind was Secretary of State, he doubtless was able to write terse memoranda in brief, pithy sentences. On one occasion, however, when he was being interviewed on radio, he was determined not to allow his interviewer the opportunity to ask any questions. He adopted the politician's trick of speaking in one interminable sentence consisting of clause after clause connected with a variety of conjunctival devices. Technically, all he said comprised one long sentence. On being transcribed, it could have been written with colons, semicolons etc. as one sentence, or it could have been conveniently broken up into short sentences, many beginning with "and". It may be true that given similar circumstances, similar subject matter, at a similar time of life, some consistency in ASL may be reasonably expected.

A different aspect of time is of greater importance to these studies. That is, the sense of the passage of time while the author is producing the work. For many years I had to conduct church services which were of exactly the same length to within a minute or two, in order to meet the accommodation requirements of several organisations. One became aware of a different attitude as the service progressed - a "beginning" attitude, a "middle" attitude and a warning "near the end" attitude. This sense of time is important with regard to the formation of prime patterns, because where these are formed, they result from the contrast between opening and closing sections. This is achieved with astonishing regularity in the Pauline epistles, which will become evident in the detailed study in Chapter 5. In many letters, the contrasting sections are almost identical in length - not in words, but in the number of sentences, though the ASLs are very different. Often the contrast is between theological and ethical sections which are easily



distinguished. But not all of the letters are constructed in this way, and even in the pastoral letters where there is no such distinction, the change in ASL occurs in the same relative position. (In using the term "sentence" in this context, reference is made, not to editorial punctuation, but to the inherent construction within the unpunctuated text.) The sense of the passage of time during dictation, played an important part in achieving the typical shape of the Pauline epistles.

## 4.7 Scale and Chaos

In 1987-89 several books were published popularising the new mathematics of chaos. Two of these were *Chaos* by James Gleick [27] and *Does God Play Dice?* by Ian Stewart [58]. Fractals and the Mandelbrot patterns were becoming well known. These patterns displayed a quality of self-similarity on an infinitely long ladder of scale levels, and the question arose as to whether scale patterns in literature were in any way related to the mathematics of chaos. The results of this investigation showed that there were important differences between mathematical scaling and the kind of scale effect found in literature. Details of this investigation have therefore been put into Appendix B, but a brief outline may be useful at this point.

The investigation followed two separate approaches. In the first, a water drip experiment was set up to examine a physical manifestation of chaos. Water from a tank was fed through a nozzle at a slow, regular drip. The rate of flow was increased so that the pattern of drips passed through the first chaotic stage, and then through various periodic modes, doublets (double drips), and triplets, with periods of chaos between them. The drips were recorded on a reel to reel tape recorder and the periods between drips were measured. These intervals were then treated just as one would treat sentence lengths, and cumulative sum graphs of variations from the average interval were drawn. The infinite scaling progression was noted, as the shorter component of one doublet seemed to provide the frequency for the next periodic mode, which in turn became the longer component of the next doublet. The range was plotted from a slow periodic drip to fast laminar flow, and while experimental conditions were too primitive to identify every change in mode, representative samples of each important mode were obtained. Particular attention was given to the behaviour of the chaotic episodes as they approached the points at which regular harmonics set in.

The second approach was mathematical. The model chosen was  $X_n = kx^2 - 1$  and a series of iterations was made substituting different values for  $k$ . At  $k = 1.74$  what Stewart calls "well developed chaos" [58, p. 20] was found. At  $k = 1.75$  an asymmetrical triplet appeared which was remarkably similar to the triplet encountered in the water drip experiments. The iterations of this model produced distribution curves for some values which were

remarkably similar to those resulting from sentence distributions. Substituting other values, the mathematical equivalents of the doublets and triplets in the water drip experiments were found. In the water drip experiment, it was difficult to obtain "pure" chaos distributions showing the typical distribution curve, because it proved almost impossible to hold the experiment at a point of equilibrium: it tended to lock on to the next harmonic.

The difference between chaotic sequences and sentence sequences was shown when three dimensional graphs were drawn of the chaotic sequences (plotting  $n: n + 1: n + 2$ ). Such a graph of  $X_n = 1.74x^2$  produced a precise curve (see Appendix B, p. 360f.). A similar three dimensional graph of a typical sentence sequence produced indeterminate results. Drawing sections through the three dimensional graph of the chaotic sequence showed precise curves at each stratum, but similar sections through the graph of the sentence distribution showed a random pattern at every level.

The deterministic character of the structure of chaos is reflected in the precise curves of the 3D graphs, and it has both physical and mathematical manifestations. Sentence distributions, on the other hand, are not deterministic in character. There is an element of randomness, plus an unpredictable element which is related to an author's moods and feelings. Nevertheless, there is, in sentence length distributions, a constant which is not found in chaotic sequences. The distribution curves, given a large enough sample, all appear to conform to the same family of curves (Appendix A, p. 347), although both the proportions of the basic curve, and the part of the basic curve found in a particular distribution, vary from sample to sample. There is nothing in sentence length distributions to correspond to the harmonics found in chaotic sequences. Sentence length distributions are not therefore deterministic as chaotic sequences are, but have their own kind of consistency.

## CHAPTER 5

### The Pauline Epistles

The contents of Chapter 5 may be summarised as follows:

There is, in the unpunctuated Greek text, an inherent pattern of pauses which is reflected with varying degrees of faithfulness in the punctuation of the modern versions. The editors who punctuated these modern texts were unaware of the effect of scale, and in some instances their interpretation violates the scale structure. There is, however, a large measure of agreement between the UBS version and Souter's edition, but in order to make valid comparisons between the Pauline epistles some adjustment to punctuation is necessary, especially in the letters to Romans, Galatians and Corinthians.

At this point, my provisional word groups, adopted in 1965 to show the scaling construction, are abandoned in favour of a fresh approach. Having established a disciplined way of dealing with questions and quotations, the boundaries regarding punctuation are established by using the UBS and Souter's versions. This provides a narrow range of options within which the interpretation of one or the other may be preferred. Very occasionally a special case will be made for the division of a particular small section of text, and reasons will be given for such a decision. This small amount of latitude will be sufficient to arrive at a text which is believed to be closer to the inherent structure of pauses than either of these versions, and which will show the fabric of the structure, respecting scale at every level.

Having established the method of text division, the next step is to

identify the prime patterns and to separate two kinds of writing. There is a clear difference between the bold patterns, which have been termed prime patterns (page 148), and other small patterns which do not show such great contrast. It is fortunate that in the cases of several of the letters - Philippians, Colossians, 1 and 2 Thessalonians and Philemon - the whole letter forms a prime pattern. It is therefore possible to determine the characteristics of this type of pattern from these letters. The UBS text may be used as it stands for this purpose, as there are few adjustments to be made regarding questions etc. Having determined the basic characteristics of the prime pattern from these letters, these data may be used to identify other prime patterns which are embedded in mixed material.

From this examination there emerges a basic motif which is found in the sentence sequence patterns of all the Pauline epistles. The motif results from placing side by side two blocks of material conceived at different scale levels. One block may contain theological material, the other ethical. Markers are identified which signal the change in scale. The clearest and most significant marker is the word λοιπόν which occurs in three letters which comprise complete prime patterns - Philippians, and 1 and 2 Thessalonians. An examination of these reveals a structure which is symmetrical in terms of sentences, but which is skewed as a result of the contrast between the different scales and different ASLs of the two main sections in each letter. This symmetry proves to be a useful feature in determining precisely the extent of prime patterns in mixed material. The prime patterns are thus identified throughout the corpus.

(Note: For the sake of clarity, the argument is based firstly on those letters which provide a complete prime pattern, and which may be used in UBS form without alteration. In these, the common features are identified which provide the base for the examination of letters in which the prime patterns are embedded in mixed material, and also of letters which require some adjustment to the text in order to reveal the scaling pattern. It has been necessary on occasion, to anticipate certain data. For example, there is little point in quoting ASLs of material which is not homogeneous in terms of scale, and in this section the ASLs quoted are those of the text as later modified in the detailed examination of letters in section 5.4. Occasional forward references are therefore given.)

The identification of the common motif and the symmetrical nature of the scaling patterns, provides the basis for the construction of a mathematical model which demonstrates how the finer detail of the sentence sequence graphs fall into place within a common scaling system. The letters are then examined individually and related to the scaling system. The disturbance of the texts in 1 and 2 Timothy and Titus is examined and solutions are proposed.

Finally, the corpus is reviewed, and a new method of classifying the Pauline texts is suggested.

Note: The graphs in sections 5.1 and 5.2 are small reproductions of tracings of larger drawings. They are used to illustrate a point in the text, and do not carry full apparatus. This is supplied in the larger graphs in section 5.4.

## 5.1 Punctuation of the Pauline Epistles

The treatment of strings of questions, quotations and glosses was raised in a general way in section 4.4.7 (page 173). In the Pauline epistles the problem is most acute in Romans, Galatians and the Corinthian correspondence. It is noticeable that when Paul is on the defensive he takes refuge in directing strings of questions at his attacker. 1 Corinthians, Chapter 9 is unique in that it contains seventeen questions in thirty two sentences. In the early part of 1 Corinthians the ASL is running at about 20 words and it is clear that the short questions at 1:20 (2, 2, 5 and 8 words) would be quite out of scale with their context if they were taken as individual sentences. It is reasonable to group some or all of these, especially the 2-word questions. If they are taken as one group they are virtually neutralised as their combined total approaches the ASL of the context. The problem is of consequence only where such strings occur within the major prime patterns. In 1 Corinthians 7-16, which consists of a series of small patterns which are related to different topics, the influence of short questions is contained within a small portion of text. The treatment of strings of questions is of greatest importance in Romans where they can have a significant impact on the shape of the graph, and it is essential that they be treated in scale with their context.

It should not be assumed that an interrogation mark must have the force of a full stop. There is indeed no immutable law of grammar which says so. On occasion it may serve the same purpose as a colon, linking the text of the question to the following sentence. In such a case it might be reasonable to take the question and the following sentence as one textual unit. Conversely, the question may be intimately related to the previous sentence. In the English text - "That's an interesting programme. Don't you think?" - the full stop after programme might be replaced by a comma, a semicolon or a colon, depending on the author. There is clearly a link between the question and the previous sentence, unless it is assumed that the ability to think of the person being addressed, is being doubted. In similar instances in the Greek text it is appropriate to group the question with the previous sentence. The content, the scale of the context and the flow of the text must all be taken into account. The principles that have been followed are therefore as follows:



1. Where a question has sufficient substance to stand on its own, and is not so directly linked to the following text as to allow the interrogation mark to have the force of a colon, then the question is allowed to stand as an independent sentence, e.g. Romans 2:26.

2. Where a question is answered by a following statement or is linked to it in such a way as to allow the interrogation mark to have the force of a colon, then the question is taken together with the following statement to form one sentence, e.g. Romans 3:31 (6 + 5 words) - νόμον οὖν καταργοῦμεν διὰ τῆς πίστεως; μὴ γένοιτο· ἀλλὰ νόμον ιστάνομεν.

3. Where several short questions are strung together, it is often found that they are linked to a concluding statement. In such cases the group of questions and the concluding statement are taken together as one unit, e.g. Romans 7:7 (3 + 3 + 24 words) - Τί οὖν ἐροῦμεν; ὁ νόμος ἁμαρτία; μὴ γένοιτο· ἀλλὰ τὴν ἁμαρτίαν οὐκ ἔγνω ἐν εἰ μὴ διὰ νόμου· τὴν τε γὰρ ἐπιθυμίαν οὐκ ᾔδειν εἰ μὴ ὁ νόμος ἔλεγεν, Οὐκ ἐπιθυμήσεις.

4. In some instances, a long string of questions may seem to fall into several groups, e.g. Romans 8:31-32 (5 + 8 + 22 words), 8:33-34 (5 + 6 + 19 words) and 8:35-36 (8 + 13 + 13 words). These groups are taken as sentence units.

5. In every case, content and the ASL of the context should be used as guides, and where the solution is unclear, it is advisable to choose the option which provides the grouping which is nearest to the ASL of the context, thus minimising the effect of the string.

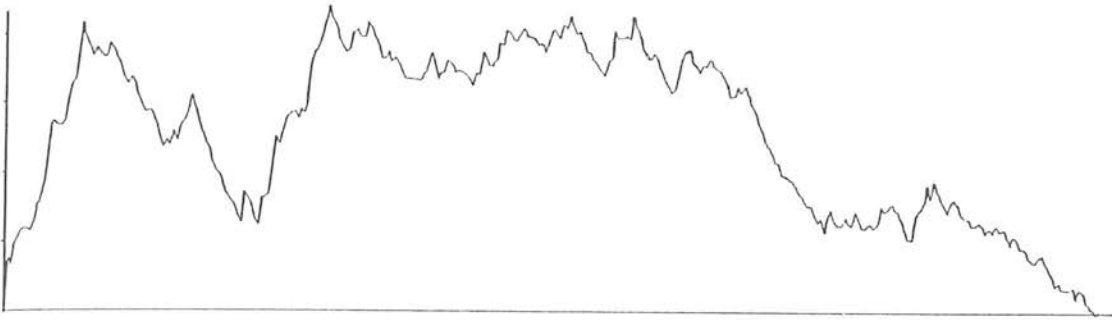
There is an inescapable subjective element in making these decisions. To minimise this an alternative approach was attempted. This involved grouping questions without reference to syntax or content. They were simply grouped with adjacent questions, or with the preceding sentence, or with the following sentence, to provide the word group which would be nearest to the ASL of the section. Separate ASLs were calculated for the first half and for the second half of the letter (See page 195 for definition of A and B sections). The word groups were then matched to the appropriate ASL as closely as possible. There is only one solution to each case from an arithmetical point of view. This crude method eliminates the subjective

element and brings the questions into scale with the context. On page 192 the graph of the unaltered UBS text of Romans 1 - 14 is compared with those prepared using the two methods. Both methods eliminate the distortion caused by short questions, and the typical high Pauline graph is achieved (See 5.2.3 on pages 201ff. for the "skewed symmetrical" form and for the explanation of that paradoxical term.). Grouping according to sentence length still distorts local patterns, especially the cyclic pattern at the beginning of the letter, and grouping according to syntax and content is to be preferred.

Quotations do not pose a serious problem as most are embedded within and absorbed into the text. Occasionally, isolated quotations have to be taken in a manner which is in scale with the context. Notes are given in section 5.4 wherever quotations are grouped.

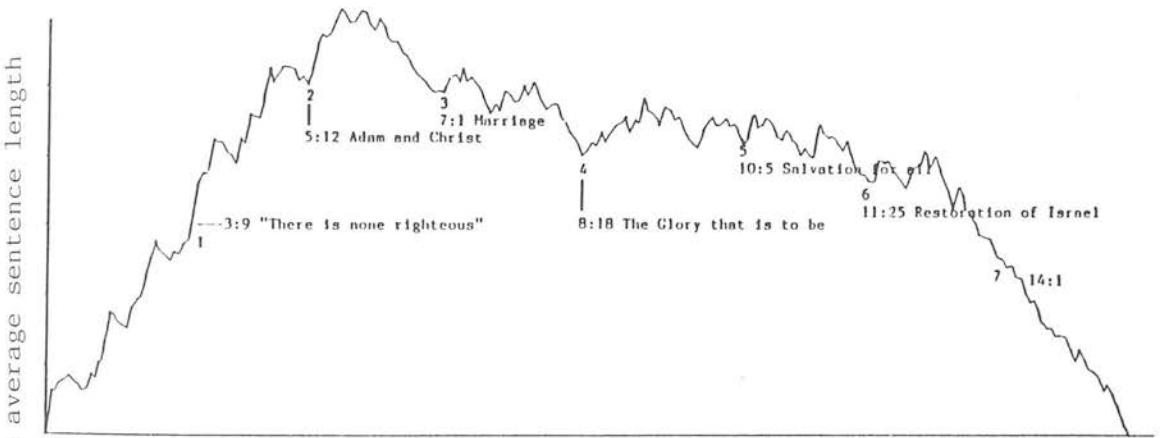
The word Amen and occasional sentences of two or three words are taken with their context in the most appropriate way to limit the undue effect which these very small units have on the overall shape of the graph. Again, notes are given wherever this is done.

As indicated above (page 187), the characteristics of the prime patterns were drawn initially from Philippians, Colossians, 1 and 2 Thessalonians and Philemon where the important features appear without any adjustment with regard to questions and very short sentences. These adjustments bring the first group closer together and clarify the underlying structure of the other epistles which contain more questions. This process is rather like bringing into focus a set of projected transparencies. If the subjects are different, then focussing the transparencies will reveal the differences: if the subjects are the same, focussing will reveal the likeness. Thus applying the same set of guidelines to the various epistles is seen to reveal similarities in the basic structure rather than differences.



SENTENCE SEQUENCE GRAPHS sentences

ROMANS CHAPTERS 1 - 14 - UBS VERSION



ROMANS 1-14 sentences

QUESTIONS GROUPED ACCORDING TO SYNTAX AND CONTENT



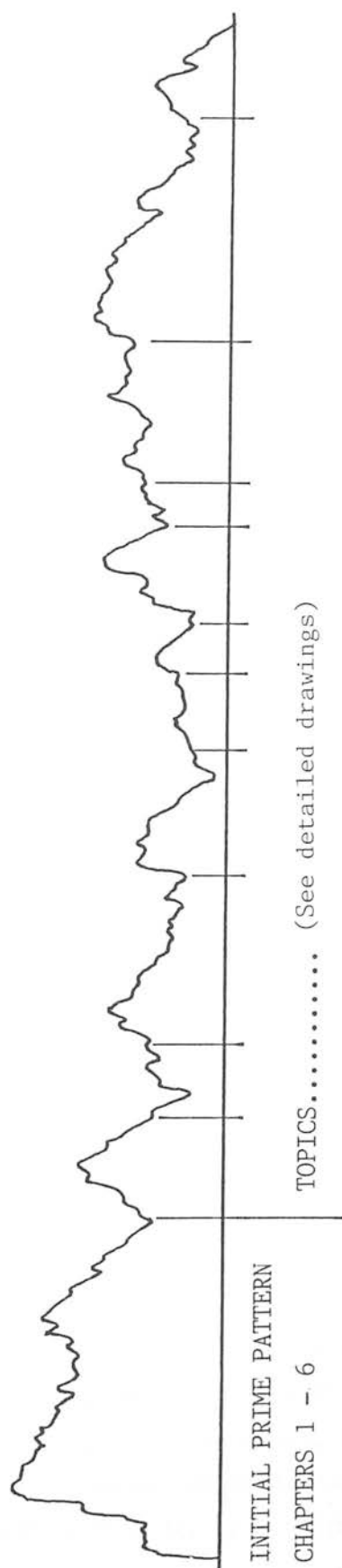
ROMANS 1 - 14 sentences

QUESTIONS GROUPED ACCORDING TO SENTENCE LENGTH

## 5.2 The Identification of Prime Patterns

Paul's writing is characterised by contrast. He often begins a letter with a series of long sentences followed by a series of short sentences. The cycle may be repeated several times. A similar contrast may be seen in the shape of the whole letter. The first half may have a much longer ASL than the second half. This results in the typical high graph when the cumulative sum of variations from average sentence length is plotted against sentence units. This is in marked contrast to the graphs of other authors' work, as reference to the collages in Chapter 3 will show (pages 113, 120 and 123). Examination of the preliminary graphs of all the Pauline epistles showed that about two thirds of the material exhibited these prime characteristics. 1 and 2 Corinthians were exceptions, as they provided low graphs with many small motifs within the overall pattern. (See graph of 1 Corinthians on page 194). 1 Corinthians 1-6 and most of 2 Corinthians 10-13 appeared to have a typically high graph indicating a prime pattern. This suggested that these portions of 1 and 2 Corinthians represented material which Paul had prepared in his mind and had dictated in one operation. The parts of the graph consisting of small motifs appeared to reflect writing of a more spontaneous nature, possibly indicating that the author was answering questions one by one. It is important to note that the high proportions of the prime patterns and the strong contrasts in ASL between the first and second halves, indicate that the material has been written or dictated in one operation. It is difficult to maintain such a clear contrast if writing is interrupted, as that would require the author to resume at precisely the same scale level at which he was writing before the interruption. Interrupted writing tends to produce text which does not depart greatly from the ASL.

There are therefore two distinctly different kinds of writing in the Pauline letters. The problem is to identify the boundaries with precision. Fortunately, several of the major prime patterns are complete letters, and having ascertained their characteristics, the remaining prime patterns may be identified and extracted from their contexts. The prime patterns forming whole letters are found in Philippians, Colossians, 1 and 2 Thessalonians and Philemon. Ephesians and Titus are also prime patterns but show some distortion, possibly resulting from additional material which has been termed "afterthought" material. This term has been used to describe material which



1 CORINTHIANS (SOUTER) - SENTENCE SEQUENCE CHART

does not form part of the typical prime pattern and which seems to have been introduced during the process of dictation, or added later. No attempt has been made to distinguish between Paul's own afterthoughts and additions by another hand.

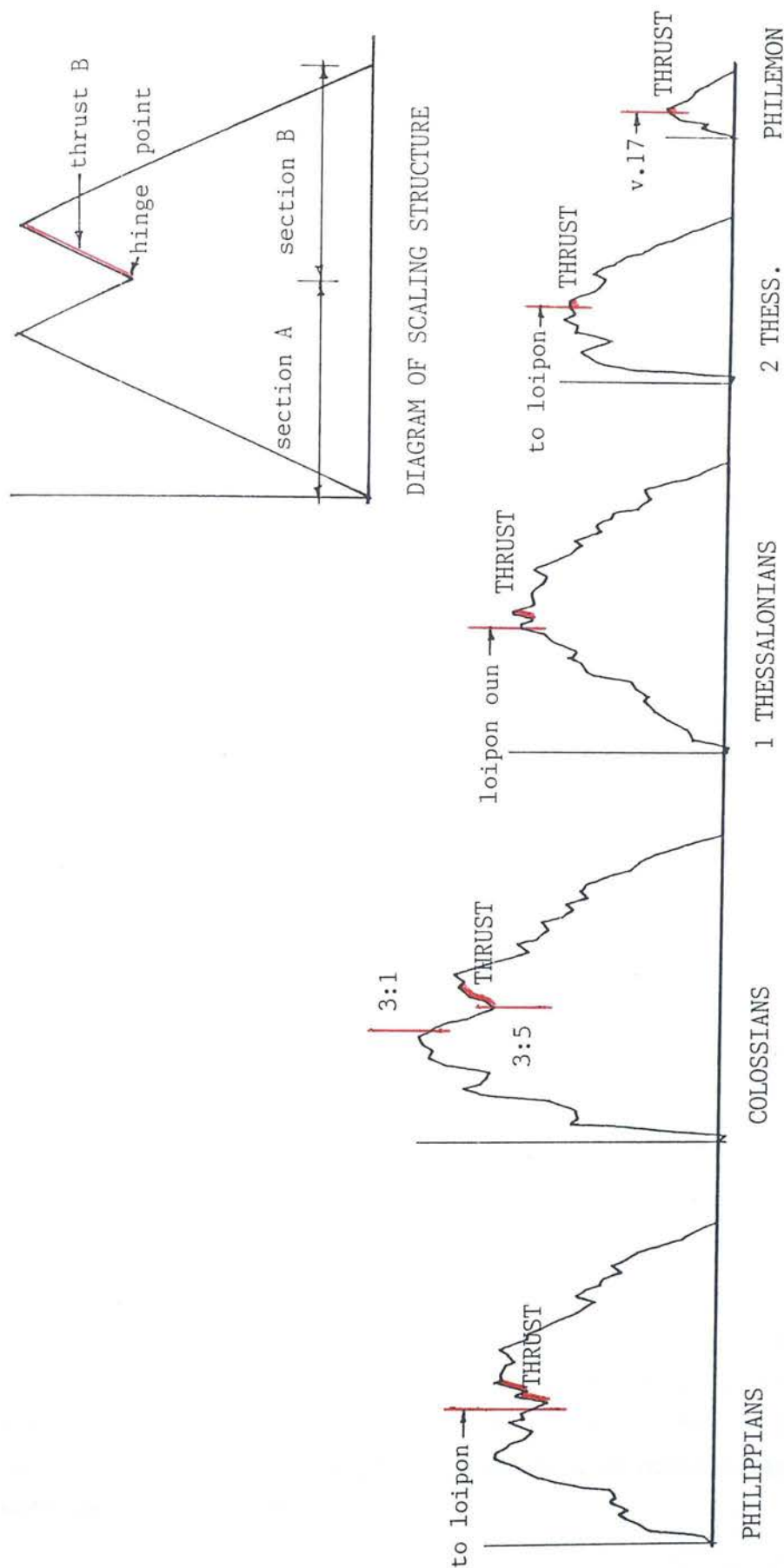
### 5.2.1 The Form of the Prime Pattern

Graphs showing the prime patterns of Philippians, Colossians, 1 and 2 Thessalonians and Philemon (adjusted as described in the detailed studies in section 5.4) are shown on page 196. These patterns cover the whole of each letter. Two forms of the construction are apparent, one of which is a development of the other. A simple construction of a series of long sentences followed by a series of short sentences will produce a cumulative sum chart of triangular form, like a Greek Delta ( $\Delta$ ). Philemon corresponds approximately to this simple form. If two such constructions of different scales are combined - a large scale block (the A section) followed by a small scale block (the B section) - then the graph will take the form of a capital **M** with a central notch. This notch is clearly seen in the graph of Philippians. The right hand slope of the central notch will correspond to the initial thrust of longer sentences in the second block (the B section). These features are shown in the diagram on page 196.

If this is indeed the underlying construction of the Pauline epistles, then it would appear possible that there might be something in the text to indicate the change of scale. A search was therefore made in the region of the notch for "markers" indicating a change of genre or subject matter which might account for a scale change.

### 5.2.2 Markers indicating Scale Changes

The Epistle to Philippians was selected, and a point at the bottom of the notch was chosen as being the most likely location at which to find a marker. Reference to the text showed that the corresponding verse was Philippians 3:1 which begins τὸ λοιπὸν - "finally". There could not be a clearer marker of a change in subject. Two sentences later there is a group of three



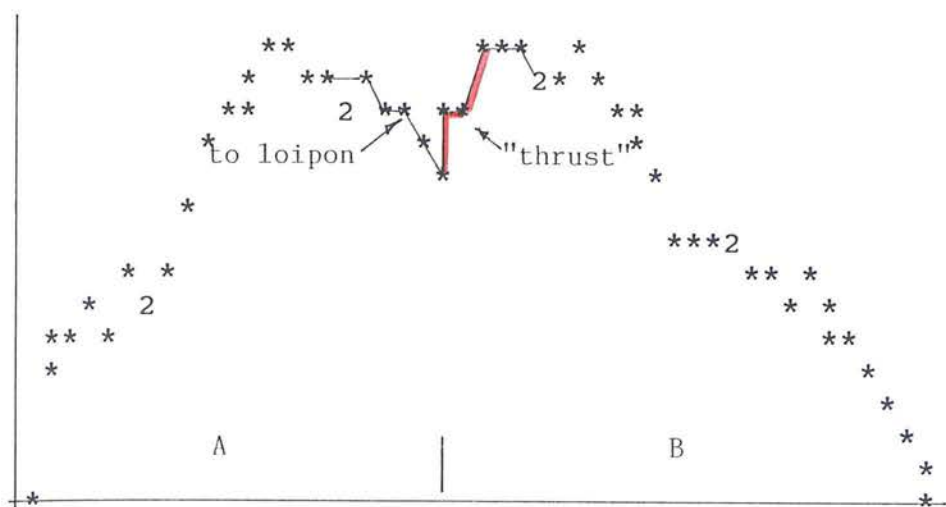
LOCATION OF "MARKERS" AND "THRUSTS" IN SENTENCE SEQUENCE GRAPHS

PAULINE EPISTLES COMPRISING WHOLE PRIME PATTERNS

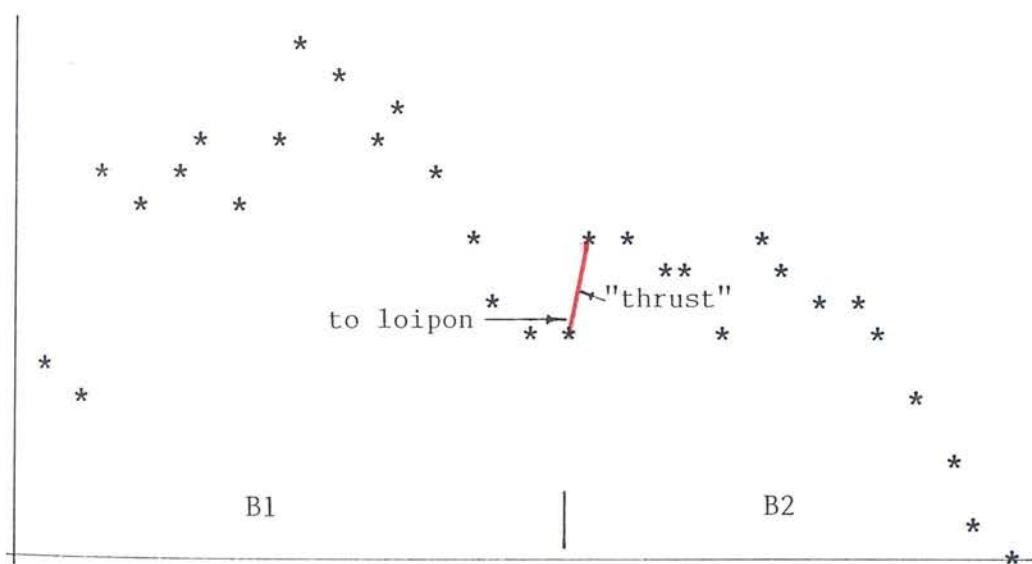


sentences which form the thrust into the B section. The positions of the marker and the thrust (in red) are indicated on page 196. The word λοιπόν occurs twice in Philippians and the second occurrence at 4:8 is of great importance. The text of the letter may be divided into two sections. Section A, the larger scale section, has an ASL of 36.54 words; section B runs from 3:2 (that verse forming the initial "thrust" of the section) to 4:23 and is on a smaller scale with an ASL of 21.90 words. This is shown in the graph at the top of page 198. The B section of the letter has been recalculated and redrawn as an independent piece and is shown in the middle graph on page 198. It will be seen that this part of the letter is a small scale version of the whole letter (showing the property of "self-similarity" which is found in chaotic series - see page 184). It has a notch in which the second τὸ λοιπόν is the marker for the initial "thrust" of section B2. The ASLs for the two parts of the B section are 25.29 and 17.79 words. This shows that the relationship between the two occurrences of τὸ λοιπόν in Philippians is by no means fortuitous, but is a very precise one in terms of scale. The construction is remarkably complex, and the process of self-similarity is seen to go further still. If section B2 is drawn out as an independent unit, it is divisible again into two parts, B2.1 with an ASL of 22.2 words, and B2.2 with an ASL of 15.33 words. There is also an initial "thrust" (into the B2.2 section) which corresponds to verse 4:15. This is an important verse referring to the Philippians' kindness to Paul. The graph of the B2 section is shown at the bottom of page 198.

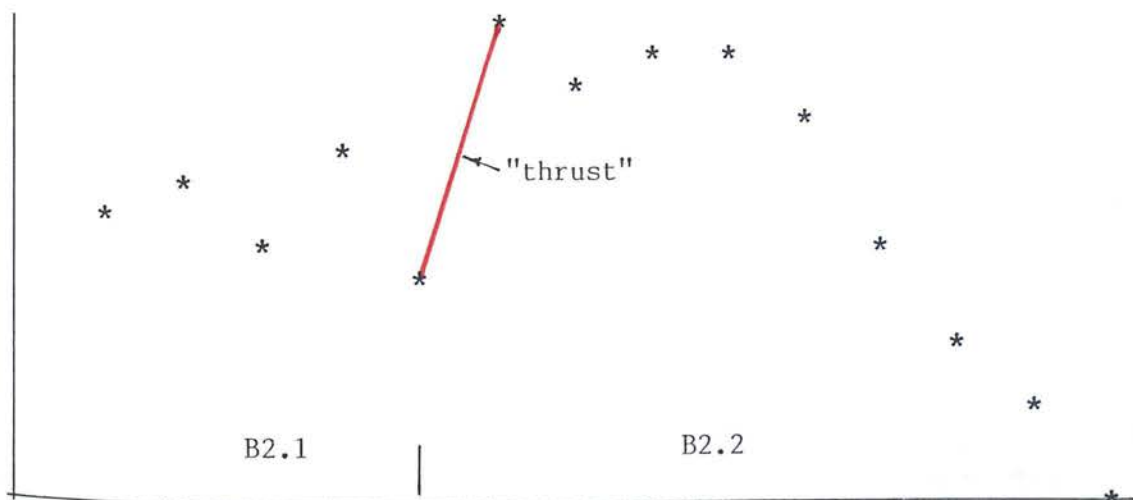
If this kind of scaling system had appeared only in my own version of the text with its subjective assessment of word groups, it might have been thought that it was a construction of my own devising. The investigation described above has, however, been based on the text of the UBS version, using UBS punctuation unaltered in any way. Nor can the scaling system be considered to be a product of the editors who punctuated the UBS version, because, as the graphs on page 199 show, the system appears also when Souter's punctuation is used. The notches can be seen in Souter's version. The thrust into section B2 is not quite so clear as it is in the UBS version because Souter has divided the long sentence which forms the main thrust. The essential topographical features are present. There is in the Pauline letters, therefore, an extraordinary system of scale relationships between the main sections of each letter.



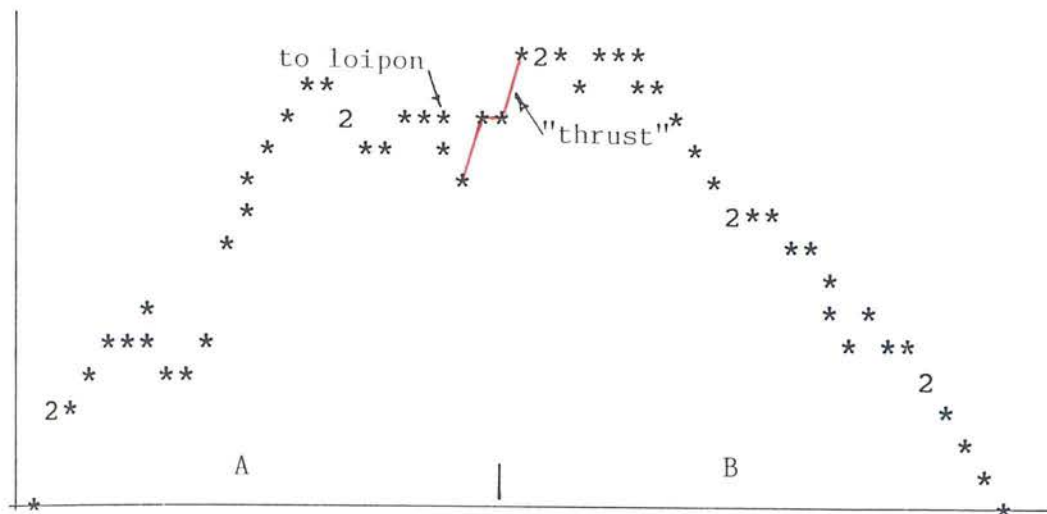
PHILIPPIANS UBS - WHOLE LETTER



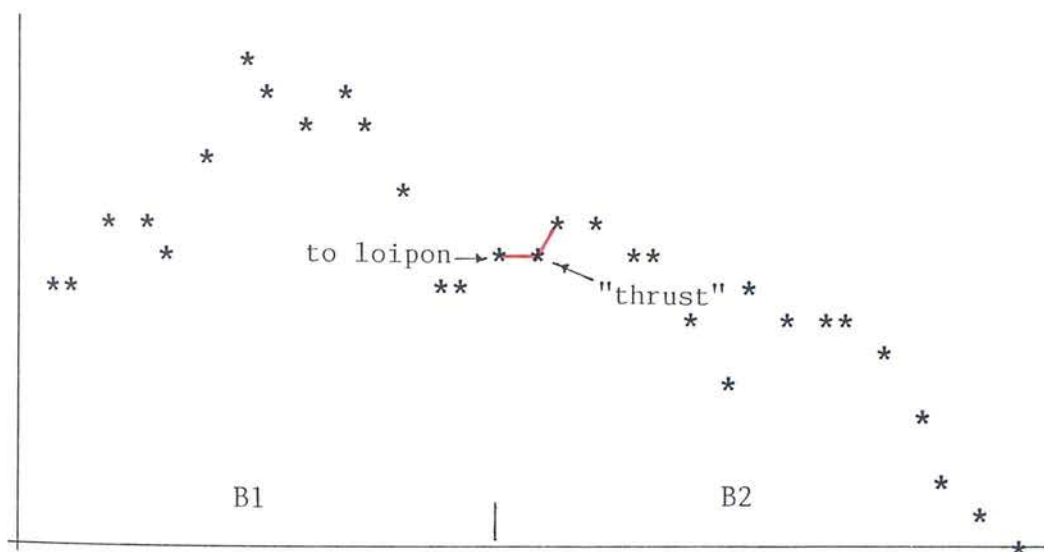
PHILIPPIANS - SECTION B



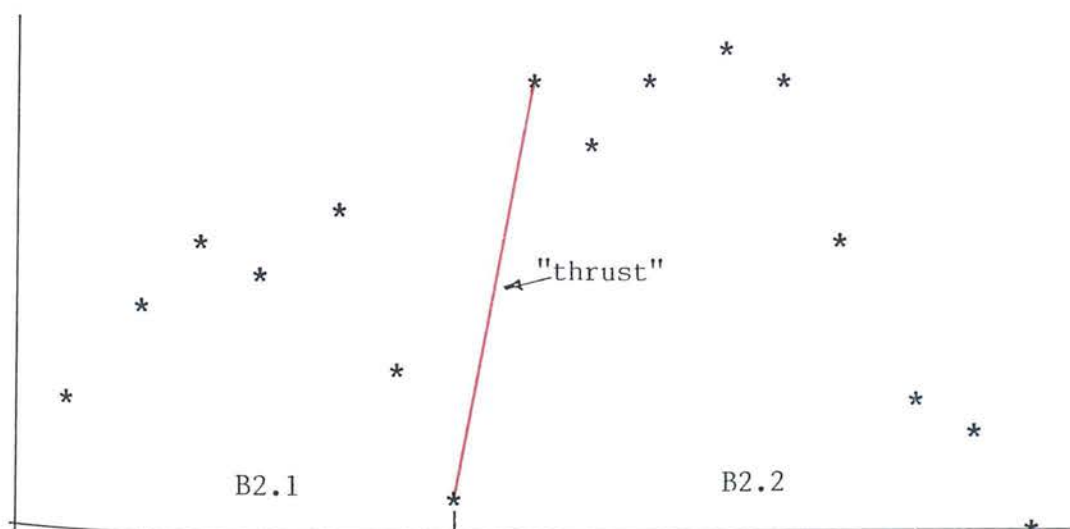
PHILIPPIANS - SECTION B2



PHILIPPIANS - SOUTER'S VERSION - WHOLE LETTER



PHILIPPIANS - SOUTER'S VERSION - SECTION B



PHILIPPIANS - SOUTER'S VERSION - SECTION B2

1 Thessalonians seems to be a development of the simple Delta type of construction, but it does have a small notch. Just to the left of the notch, an occurrence of the marker λοιπὸν οὖν was found at 1 Thessalonians 4:1. It is followed by the thrust of a long sentence concerning instructions about living a holy life. These are marked in red on page 196. The ASLs of the two sections are 34.27 and 21.85 words. It was noted that the word λοιπὸν occurs twice in 1 Thessalonians. The first occurrence is of no significance regarding scaling: it refers to Paul's wish to visit the Thessalonians.

2 Thessalonians also produced τὸ λοιπὸν at 3:1 (marked in red on page 196). This letter does not have such a well formed notch and is of the simpler type of construction: the sentence containing τὸ λοιπὸν constitutes the thrust of the second section, and forms the right hand slope of the notch. The ASLs of the two sections are 42.23 and 19.57 words.

Colossians does not have a τὸ λοιπὸν marker. Instead it provides a change from the theological to the ethical. There is a theological climax at 3:1-4 - "Your real life is in Christ and you will share his glory!" This is followed by the change to the ethical at Colossians 3:5 - "You must put to death the earthly desires...." These positions are shown in red on page 196. The ASLs of the sections are 51.53 and 23.19 words respectively.

Philemon is a very short letter and the construction is of the simple Delta form. The punch line comes at v. 17 - "So if you consider me your partner, receive him as you would receive me." This is the thrust of the letter, and even in such a tiny piece, it occurs in the expected position which is marked in red on page 196. The ASLs of the sections are 40.00 and 15.11 words.

5.2.3 Skewed Symmetry

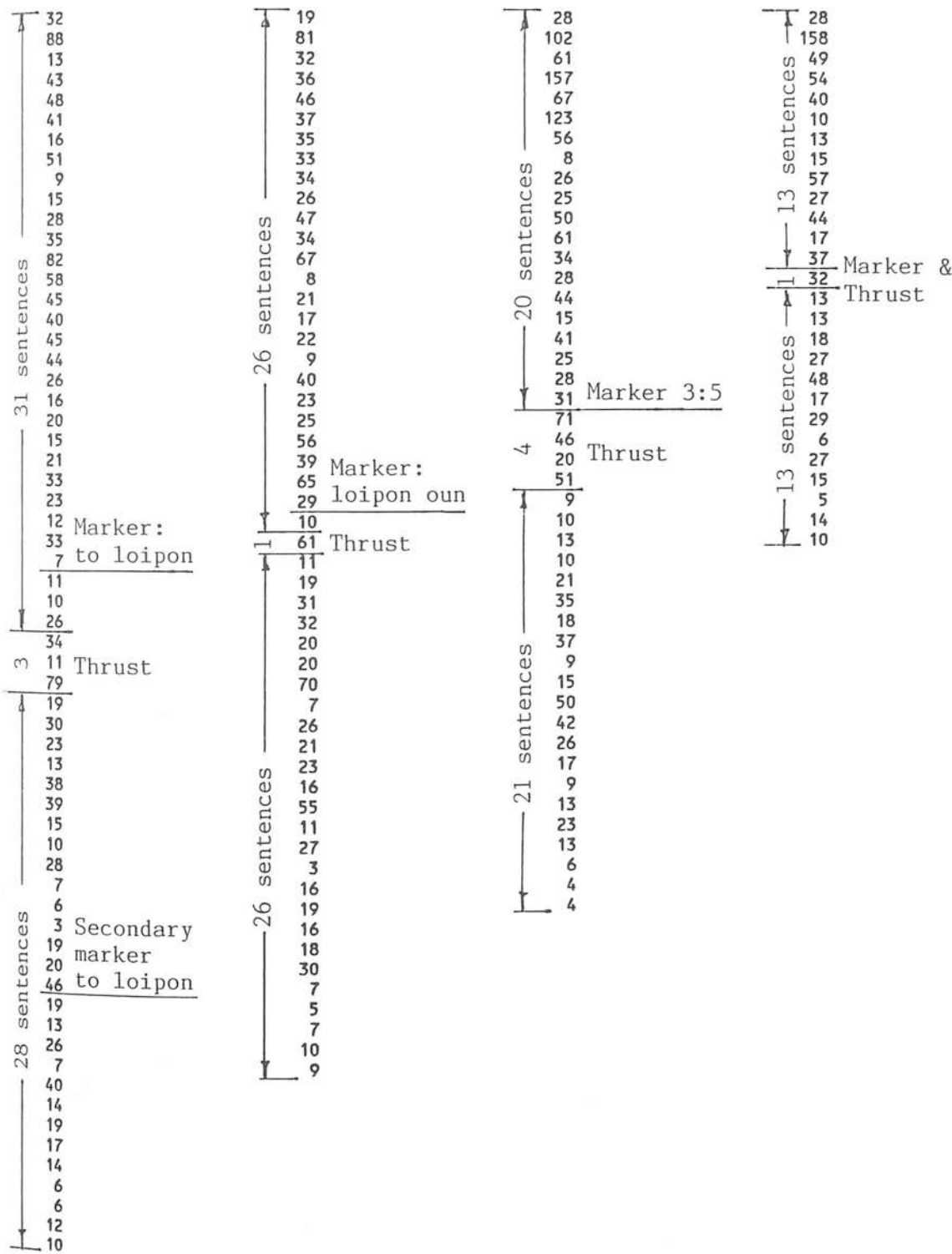
In section 5.2.2 it was seen that the basic substructure of the Pauline prime pattern, when drawn as a cumulative sum graph of sentence sequences, assumes an **M** shaped form with a central notch. The right hand slope of the notch corresponds to the main initial thrust of the second section. Each graph may be divided into three sections, the first A section consisting of a batch of sentences with a longer than average ASL; the second consisting of the sentence or sentences forming the main "thrust" into the B section; the third consisting of a batch of sentences with a shorter than average ASL. The "thrust" is easily identified by locating the marker and then taking the next sentence or group of sentences which has a higher than average sentence length. Those epistles which each comprise a single prime pattern and which show the notched form, may be divided into these three sections, using the UBS version without any alteration to the punctuation. They are as follows (with figures based on Souter's edition in brackets):

<u>EPISTLE</u>	<u>SECTION 1</u>	<u>SECTION 2</u>	<u>SECTION 3</u>
1 THESS.	26	1	26
	(25)	(1)	(28)
2 THESS.	13	1	13
	(11)	(1)	(15)
PHIL.	31	3	28
	(28)	(3)	(30)
COL.	20	4	21
	(21)	(3)	(24)

This shows a remarkable symmetry in terms of sentences before and after the thrust into the B section. The punctuation of these versions has not been altered in any way. The identification of markers and thrusts in the UBS version is shown on the lists of sentence lengths on page 202. It must

IDENTIFICATION OF "MARKERS" AND "THRUSTS" IN THE PAULINE EPISTLES

PHILIPPIANS	1 THESSALONIANS	COLOSSIANS	2 THESSALONIANS
PHILUBS.DAT	1THSUBS.DAT	COLUBS.DAT	2THUBS.DAT
sum c1 1629	sum c1 1481	sum c1 1582	sum c1 823
mean c1 26.274	mean c1 27.943	mean c1 35.156	mean c1 30.481
sentences 62	sentences 53	sentences 45	sentences 27



be noted that the symmetry is in terms of sentences, but the patterns are also greatly skewed because of the great differences between the ASLs of the A sections and those of the B sections. In terms of sentences these epistles are symmetrical: in terms of words they are severely skewed. This property is remarkably consistent, and as the interpretation of the punctuation is fine tuned in respect of scale, this symmetry will provide a useful aid in determining the extent of prime patterns where they are coupled with other material.

Note: To those who are sceptical about the internal structural symmetry of the Pauline epistles, I would recommend the above exercise using the unaltered UBS punctuation. The figures using Souter's version provide confirmation that there is a general symmetry in these texts. This group of epistles does not require much adjustment to secure homogeneity in terms of scale. More adjustment is needed in the Romans/Galatians group as they contain more groups of questions. While it would be simple to obtain precise symmetry in the process of making those adjustments, I have refrained from doing so as there is no point in creating a greater degree of symmetry than there is inherent in the text. I have therefore adhered to the groupings of questions which I made before this symmetry became apparent. Nevertheless the symmetry in the other epistles is, in some instances, surprisingly precise.

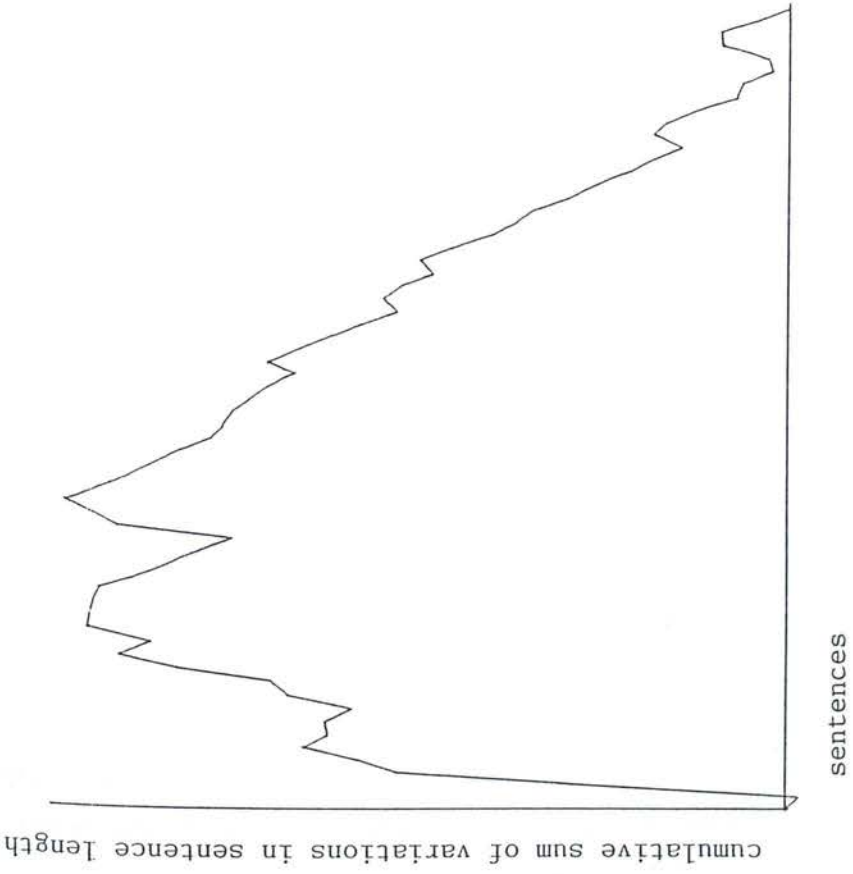


## 5.2.4 Embedded Prime Patterns

The term "embedded" is used loosely to embrace all those prime patterns which are combined in an epistle with secondary material. The prime pattern may be totally enclosed or may have sections of secondary material attached to the beginning or the end of the pattern. In this section the prime patterns are detected in Ephesians, Romans, Galatians and the Corinthian epistles. The graphs of 1 and 2 Timothy and Titus show signs of disturbance and these will be dealt with in section 5.4 when the epistles are examined in detail.

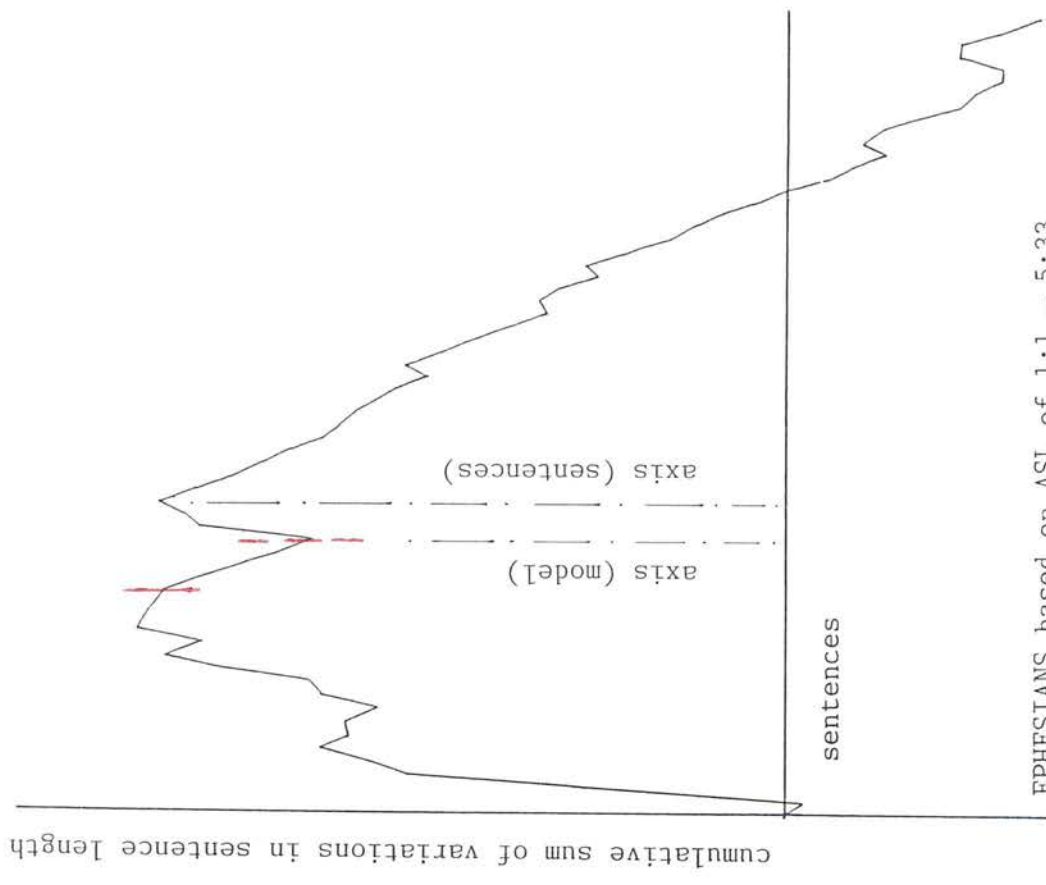
The epistle to Ephesians is taken first as it provides a case in which there appears simply to be some additional material at the end of the letter, and the main part of the letter provides a close match with the pattern of Colossians. The sentence sequence graph using Souter's text is shown on the left hand side of page 205. It has the essential features of a prime pattern but it appears to be skewed to the left. The "thrust" part of the notch is not placed over the centre of the base line. There is too much material towards the close of the letter to give it the balanced form which the other prime patterns possess. The curious little humps at the end of the graph look like an afterthought. In the middle of them is yet another τὸ λοιπόν. The problem is to tell how much afterthought material there is. An alternative rendering is shown in the right hand graph on page 205 in which the ASL is calculated on the text ending at 5:33. It will be seen that the portion of the graph above the base line now matches the other prime patterns closely, and symmetry is restored. The remaining portion of the graph below the base line can be considered to be an "afterthought" pattern. The implications of this are considered later when the letter is examined in detail (pages 248ff.).

There is no τὸ λοιπόν marker in Ephesians: instead there is a change from the theological to the ethical. Ephesians 4:5,6 provides the theological high note - "One Lord, one Faith, one Baptism...." - followed by the transition to the ethical - "Each has received a special gift". The point where the change occurs is marked by a red line on page 205. It is slightly left of the expected position which is indicated by a broken red line. The space between these two points is occupied by vs. 8-10 which is a rather



SENTENCE SEQUENCE GRAPH

EPHESIANS 1:1 - 6:24 - Souter's punctuation.

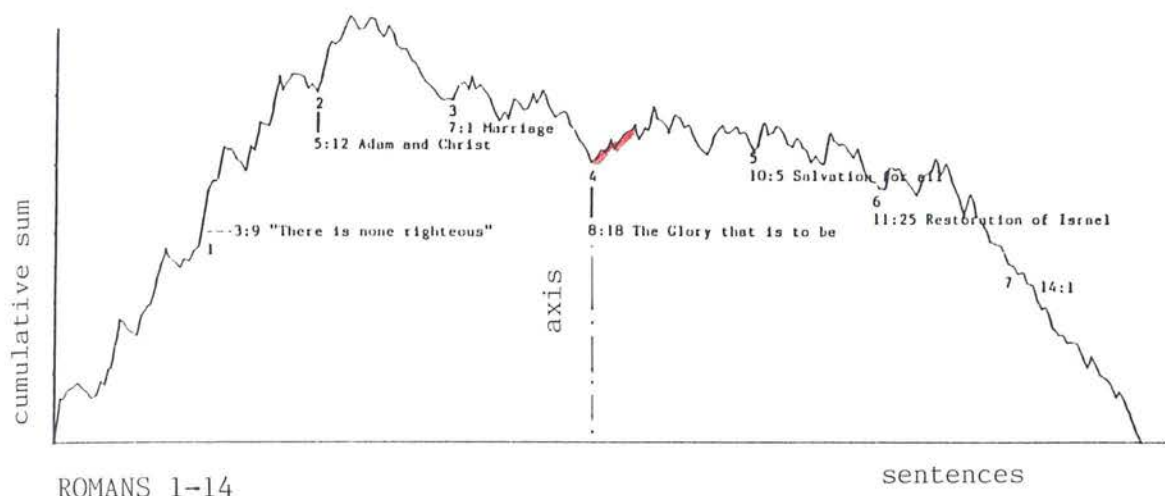


EPHESIANS based on ASL of 1:1 - 5:33

distracting comment on Psalm 68:18. This may be an early gloss. It is not of great importance as the thrust often comes a few verses after the first signal of an impending change. In this case the main thrust comes at v 11 - "And his gifts were that some should be apostles...." (marked by the broken red line). There is the expected contrast in ASL between the two sections - 57.48 and 28.93 words respectively. (There are two axes shown on page 205. The axis of the model (see section 5.3) is always on the central hinge point. The axis of symmetry found in the sentence pattern is not so precise and lies between the beginning and the end of the "thrust". In the case of Ephesians it lies nearer the end.)

The epistle to Romans provides a graph which at first sight may appear to be different from the type seen in the Ephesians/Thessalonians group, but it does have a central notch and a thrust. In the UBS version, the ASL of Chapters 1-14 is 26.14 words. In Chapter 15 it rises to 27.15 words. In the last chapter it falls to 15.7 words. (See 5.4.1 for further comment on this.) The true form of the graph cannot be seen until the punctuation has been adjusted and strings of short questions and quotations have been dealt with (pages 227f.). After drawing trial graphs of different combinations it was found that Chapters 1-14 provided the skewed symmetry which is the hallmark of those letters which comprise complete prime patterns. The prime pattern is shown on page 207. The change between the A and B sections occurs at Romans 8:18, and the thrust into the B section is provided at 8:20 with the majestic vision of the whole creation being set free and obtaining the glorious liberty of the children of God. This is marked in red on the graph on page 207. The ASLs of the sections are 29.63 and 22.79 words.

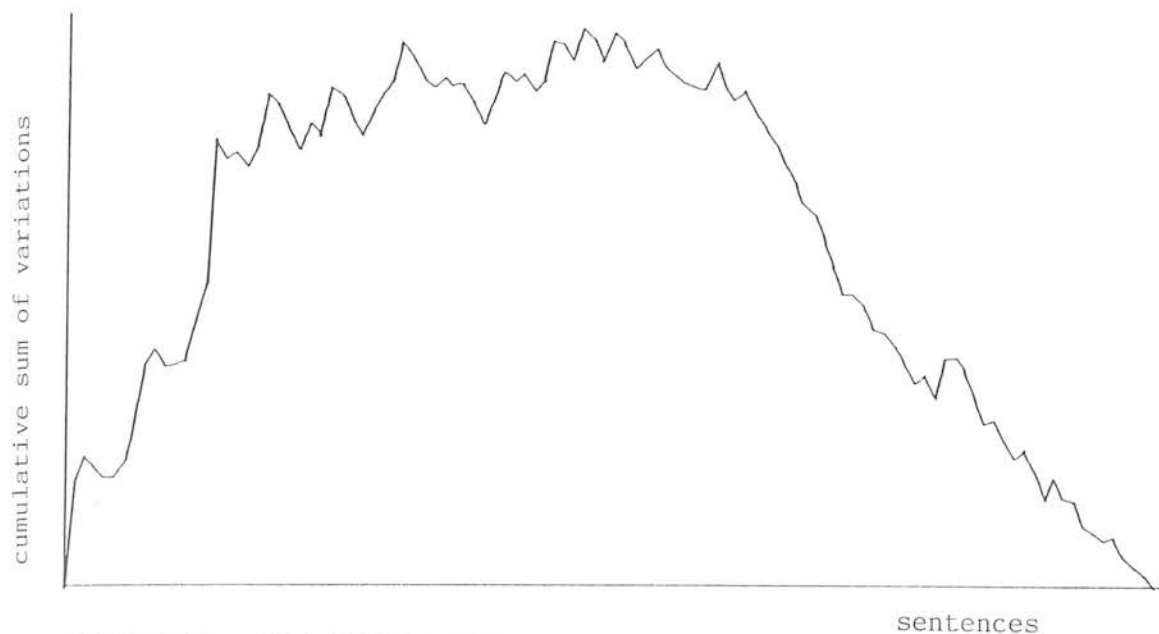
The epistle to Galatians provides a sentence sequence graph which appears to be a small scale version of Romans. A few questions need to be grouped to be in scale with their context, as noted in section 5.4.4 (page 244). The graph at the top of page 208 shows the whole letter with UBS text with questions adjusted. Like Ephesians and Romans, it is clearly skewed by secondary material at the end of the letter. The lower graph is drawn to the ASL of 1:1 - 5:15, which is clearly the symmetrical portion, and which constitutes the prime pattern. The portion below the base line represents secondary material. This begins at 5:16 and contains the passage on the Fruits of the Spirit, some sundry words of advice and the postscript in



ROMANS 1-14

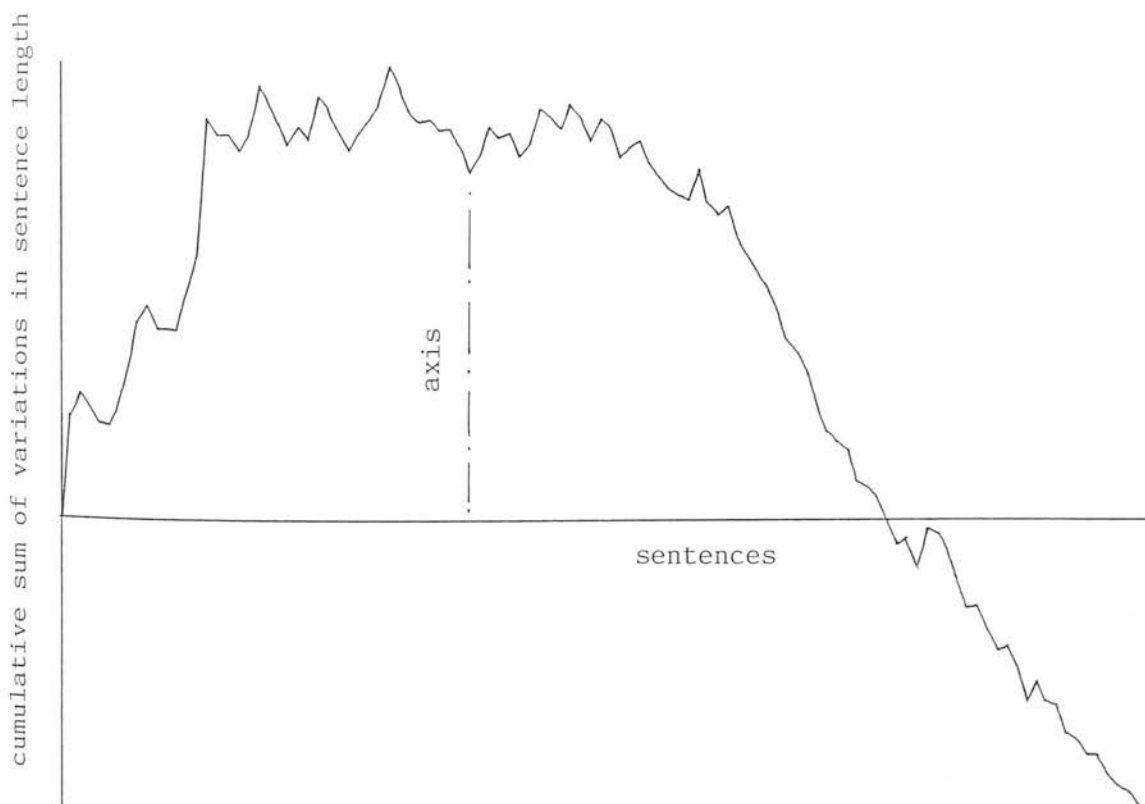
sentences

QUESTIONS GROUPED ACCORDING TO SYNTAX AND CONTENT



GALATIANS - UBS PUNCTUATION

QUESTIONS GROUPED



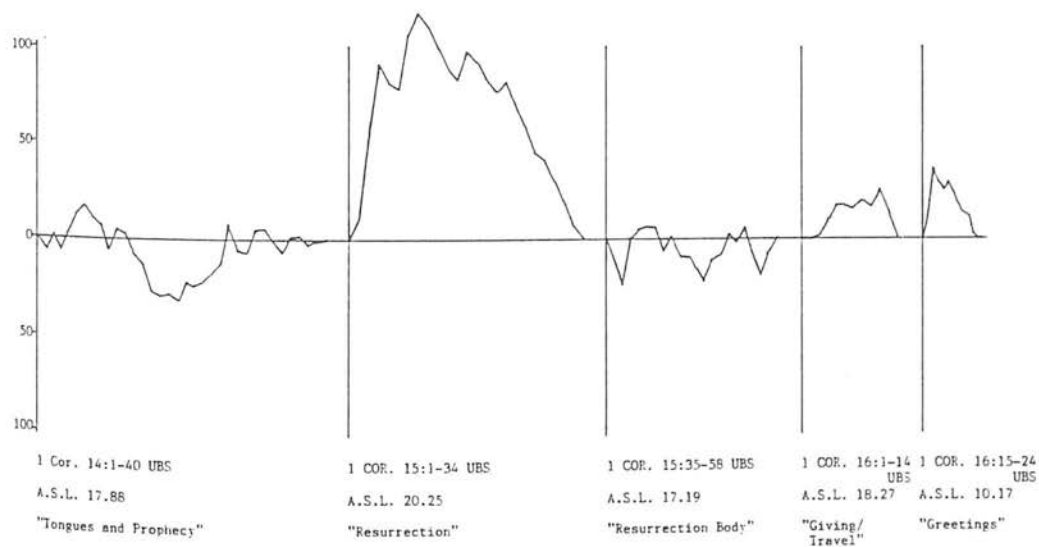
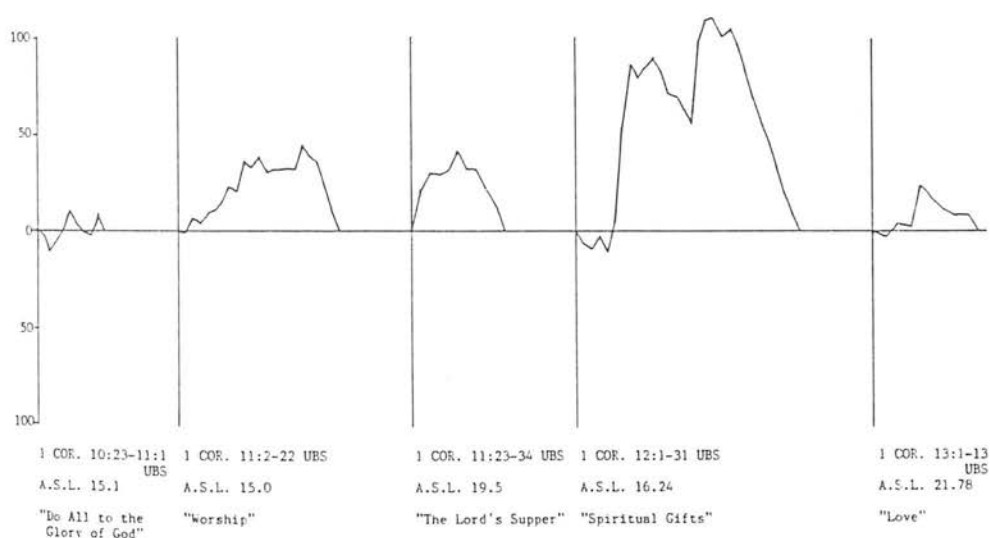
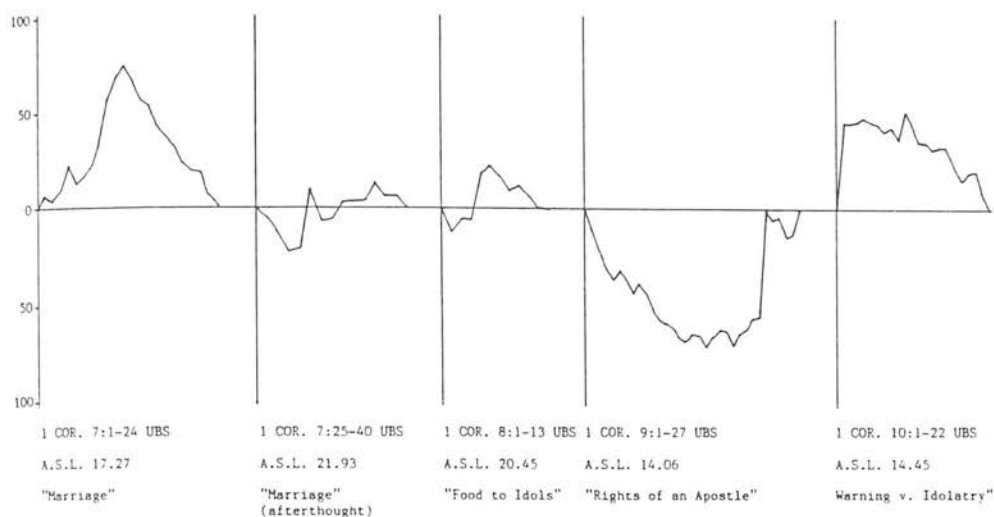
GALATIANS - UBS PUNCTUATION WITH QUESTIONS GROUPED

CALCULATED ON ASL OF CHAPTER 1:1 TO 5:15

Paul's own hand. When this portion is removed the rest of the pattern shows the skewed symmetry which is characteristic of the prime pattern. The change of scale occurs at 3:21b when Paul turns from the Law to salvation through faith. This great theme provides the initial thrust of the B section. The ASLs of the A and B sections are 26.44 and 17.76 words.

1 Corinthians provides an opening prime pattern comprising the first six chapters, followed by a series of small motifs which may be related to different topics. The graph of the whole letter is shown on page 194, and the graphs of the topics are shown as individual pieces on page 210 (larger reproductions are provided on pages 232-4). The graph of the prime pattern taken in isolation is shown on page 212. The thrust of the B section comes after the central notch at 4:5 - "Therefore do not pronounce judgement before the time, before the Lord comes...." The ASLs of the A and B sections are 22.69 and 16.29 words. One of the topics, the passage on resurrection in 15:1-34, provides a miniature prime pattern. This is later compared with the graphs of Ephesians and Colossians (pages 254f.).

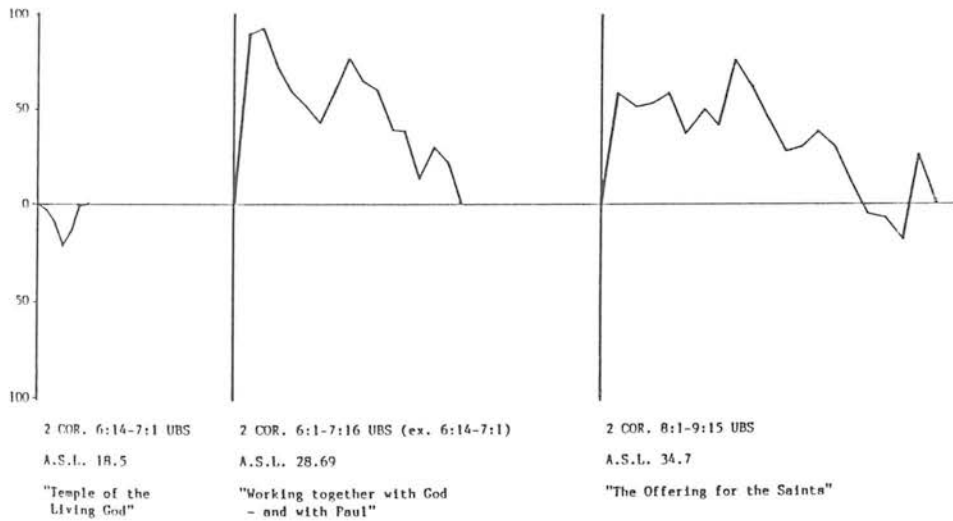
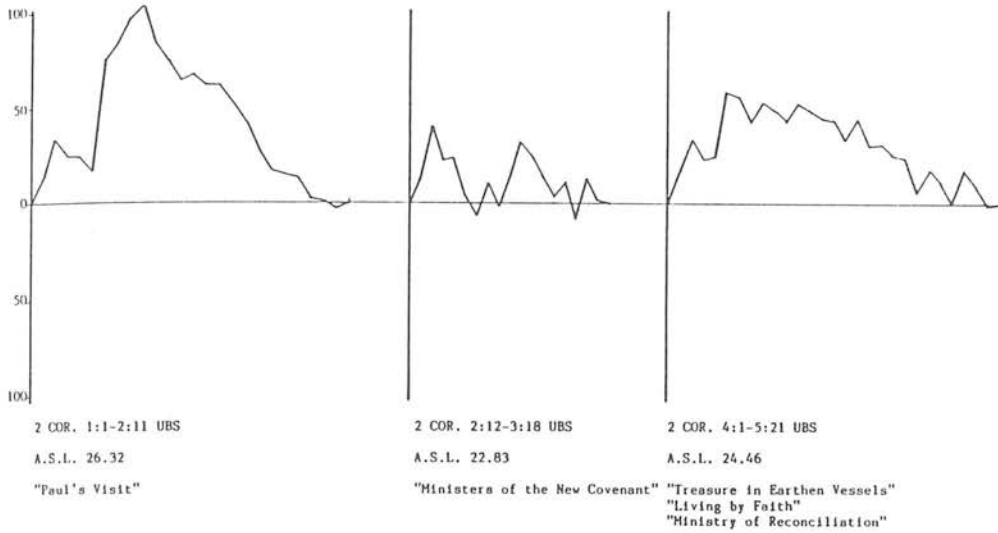
2 Corinthians provides a series of six topics in the first nine chapters. The sequence graphs of these are shown on page 211. The first is a small prime pattern similar in structure to Philemon, but on a larger scale. Chapters 10 - 13 provide a major prime pattern with greetings missing from the beginning and with some secondary material at the end. This confirms the view of many scholars who regard Chapters 10-13 as a separate letter. At 12:14 Paul writes, "Here for the third time I am ready to come to you". The fact that this is repeated at 13:1 is a signal that Paul completed his prepared material about the end of Chapter 12, and that on resuming, added Chapter 13. The long last verse of Chapter 12 is an unlikely ending to the prime material: it is more likely that it forms the initial thrust on the resumption of dictation. I would judge that the prime pattern ends at 12:19. The opening greetings in a severe letter such as this might be expected to be fairly terse, and I would suggest two sentences, one of salutation and one of thanksgiving. To allow for this I have inserted two verses matching 1 Corinthians 1:1 and 2. This provides the expected symmetry. The sequence graph, prepared on this basis, is shown on page 212. The notch is clear and in the correct position, and the thrust into section B is at 11:24 - the passage on Paul's sufferings. The ASLs of the sections are 25.33 and 15.93 words.



1 CORINTHIANS 7 - 16, UBS PUNCTUATION

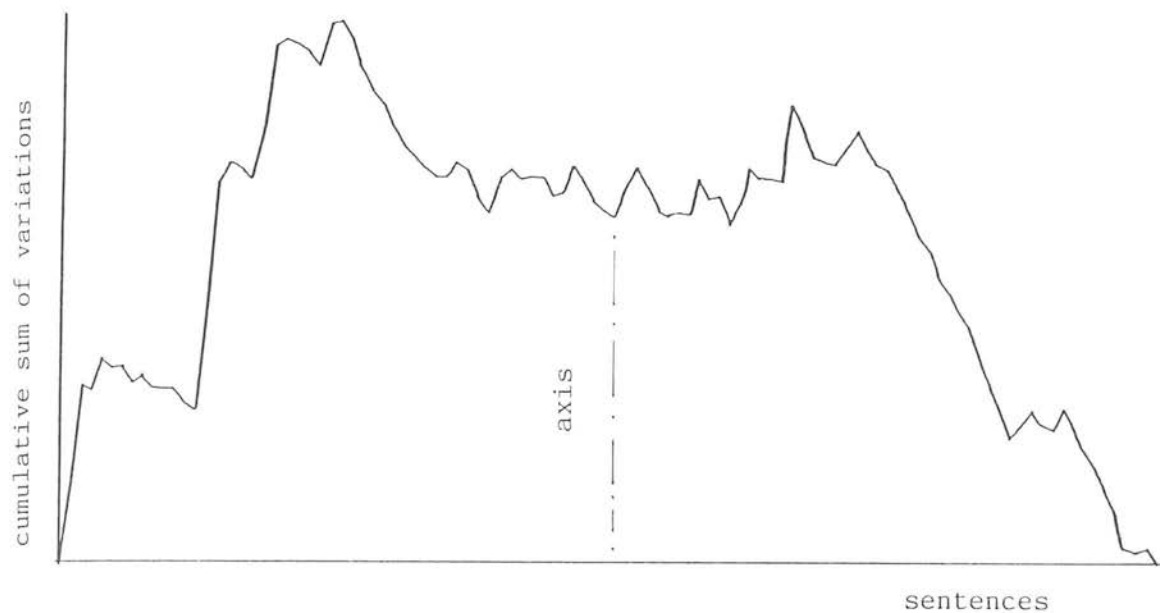
EACH TOPIC TREATED AS A SEPARATE PIECE





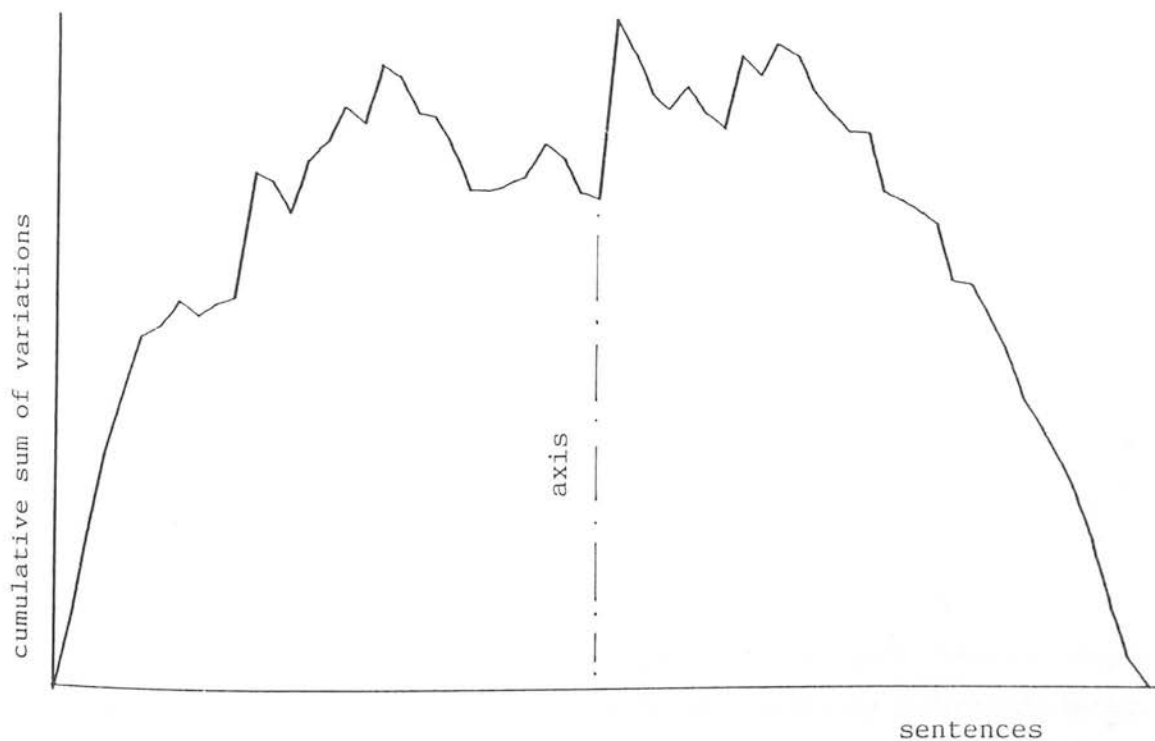
2 CORINTHIANS 1 - 9, UBS PUNCTUATION

EACH TOPIC TREATED AS A SEPARATE PIECE



1 CORINTHIANS 1:1 - 6:20 UBS PUNCTUATION

QUESTIONS ADJUSTED



2 CORINTHIANS 10:1 - 12:19 UBS PUNCTUATION

QUESTIONS ADJUSTED AND "GREETINGS" INSERTED

## 5.3 A Mathematical Model for the Pauline Epistles

In section 5.2 a common scaling structure was found in the letters to Philippians, Colossians, 1 and 2 Thessalonians and Philemon (page 196). This consists of two blocks of material, one conceived on a larger scale, followed by a block conceived on a smaller scale. This produces the typical triangular cumulative sum graph with a V-notch placed centrally. At the bottom of the V-notch is what I have termed the "primary hinge". The portion of the letter before the primary hinge is labelled the A section, the portion after it is labelled the B section (diagram on page 196).

These basic features can also be seen in the Romans/Galatians group, but in the longer prime patterns with a low ASL, local variations conceal these features to some extent. It appeared possible that the relationship between the Romans/Galatians group and the Ephesians/Thessalonians group was a scale relationship of some complexity. The long letters with low ASL allow for the development of more local detail than is possible in shorter letters with a high ASL. This was noted in 1965 when I did a study of the cyclic patterns of the opening sections of the letters. Paul's habit of opening with a series of long sentences followed by a series of short sentences, produces a stepped pattern in the cumulative sum graph of sentence sequences. The number of steps varies from one to five. The number depends simply on the relationship between the ASL and the total number of words available in the prime pattern. Romans, with a huge prime pattern and a low ASL produces the greatest number of steps. Ephesians and Colossians have a large ASL and fewer sentences in the letter. Thus there is only scope for one or two steps. When I did that study, I was greatly puzzled as to whether the stepped pattern was an "opening pattern" restricted to the first section of each letter, or whether the cyclic pattern persisted right through the graph. The letter to Philippians is now seen to have a quality of self-similarity in all its sections, pointing to a more sophisticated scaling system (page 197 and graphs on pages 198f.). This suggested a system which might embrace all the epistles.

The proposed model is constructed in accordance with these two main observations - firstly that Paul frequently begins a letter by contrasting series of long and short sentences, and secondly, that the prime pattern consists of

a block of larger scale material stacked against a block of smaller scale material, creating a construction with the property I have described as "skewed symmetry". These characteristics in Paul's writing are not mathematically constant. The features recur time and time again, but proportions and dimensions vary, letters being very human creations. Unlike Paul's material, the mathematical model would be mathematically consistent, but the important property which it must possess would be to reflect the features - one might call it the topography - of the pattern inherent in the texts. (Two objects may have a similar topography, that is, similar essential features, and yet be quite different in dimension and proportion. It is the similarity in feature that is important in this study.)

### 5.3.1 The Construction of the Model

From a mathematical point of view the procedure is very simple. Two numbers are selected to represent the relationship between the long and the short sentences of Paul's opening sections. A ratio is then selected to represent the relationship between the ASLs of the opening A section and the latter B section of the prime pattern. The particular values are not very important. They interact with each other and affect the degree of skew in the cumulative sum graph, and they affect the degree in which local variations are expressed, but the topography of the model remains essentially the same whatever values are selected. It is not possible to take these ratios directly from Paul's letters, because they vary considerably from letter to letter. This is because the contrast between the distributions of the longer and the shorter sentences varies from letter to letter, possibly reflecting changes of mood.

After some trial, I settled for 12/4 for the two numbers and 1:1.5 for the ratio: these seemed to give useful comparisons for most of the epistles. (In the case of Romans, 12/3 and a ratio of 1.33:1 produce a more exaggerated saw-tooth pattern which gives a better simulation of the pattern of the letter.) The two numbers represent LEVEL ONE of the model. A cumulative sum graph of the two numbers would produce a triangular form as the first number represents a long sentence and the second number represents a shorter sentence. A computer version of the graph (using

Minitab) is shown on page 216 with some intermediate points added to show the form more clearly. The sequence of numbers is **12 / 4**.

These two numbers are then stacked against the same numbers increased by 50% (representing the chosen ratio of 1:1.5) to provide LEVEL TWO. The cumulative sum graph assumes the form of the capital **M** with the central notch (See page 195 and diagram on page 196). The graph is shown on page 216. The sequence of numbers is **18 - 6 / 12 - 4**.

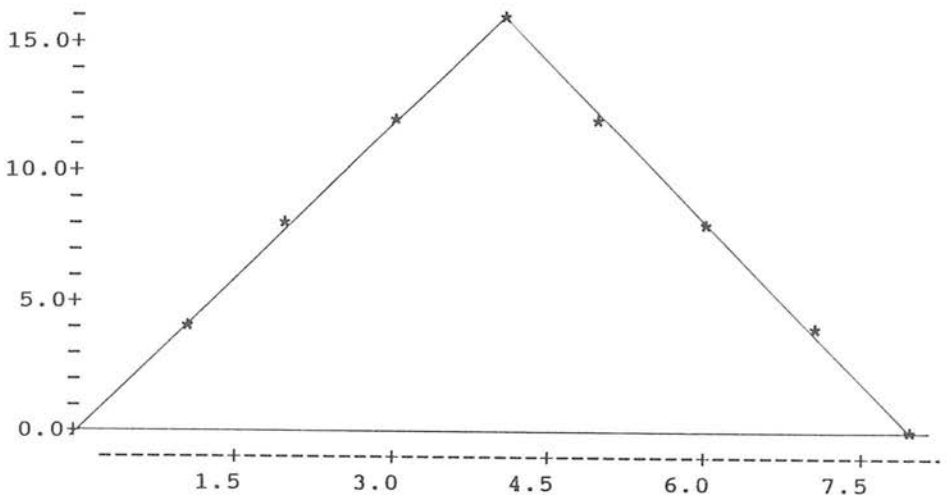
This whole group is then stacked against a similar sequence with all the numbers increased by 50% giving LEVEL THREE. The graph is shown on page 216. The sequence of numbers is **27 - 9 - 18 - 6 / 18 - 6 - 12 - 4**. The oblique stroke in these series of numbers represents the primary hinge. Some of the Pauline letters were found to have similar feature to Level Three of the model. Computer versions of Level Three and of Ephesians are shown on page 221.

At this stage the graphs represent the author's habit of contrasting series of long and short sentences, combined with a decrease in the ASL of these groups as the letter progresses. This is conceivable, even though it should be noted that the author has to stay with the 18/6 ratio for a double period if the topography of the typical Level Three pattern is to be produced. Nevertheless, such a habit is conceivable.

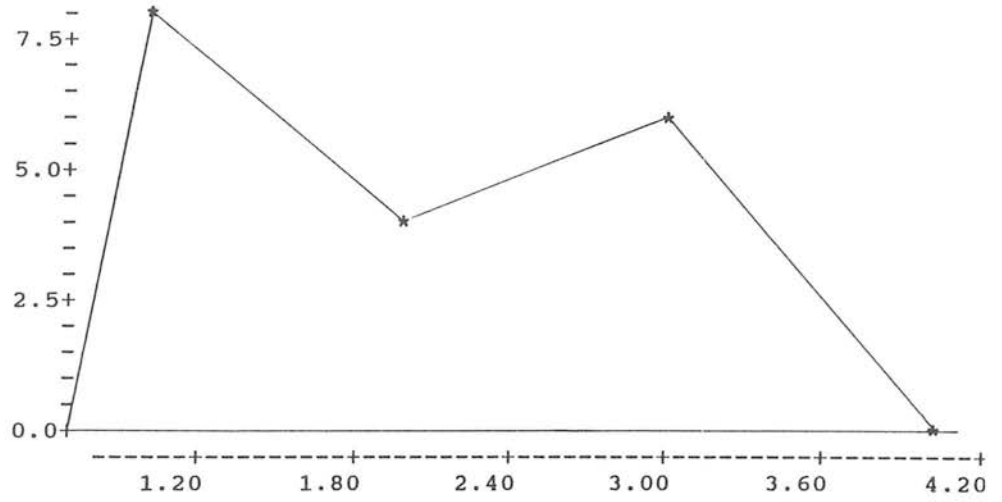
The next step introduces a significant feature. The LEVEL FOUR figures are as follows - **40.5 - 13.5 - 27 - 9 - 27 - 9 - 18 - 6 (primary hinge) 27 - 9 - 18 - 6 - 18 - 6 - 12 - 4**. At this level the pairs of figures no longer decrease continuously. At the primary hinge they increase, that is, the B section begins with a cycle at a higher scale level than the last cycle in the A section, yet the whole B section is a replica of the A section at a lower scale level. These scaling overlaps occur increasingly at each higher scale level indicating an interwoven scale structure. It is difficult to imagine how the subconscious mind of an author can produce such an interwoven structure.

Initially this study was based on the Prison Epistles which at first sight seemed to correspond with Level Three or possibly Level Four. Out of curiosity the figures were taken out for Levels Five and Six and it was with

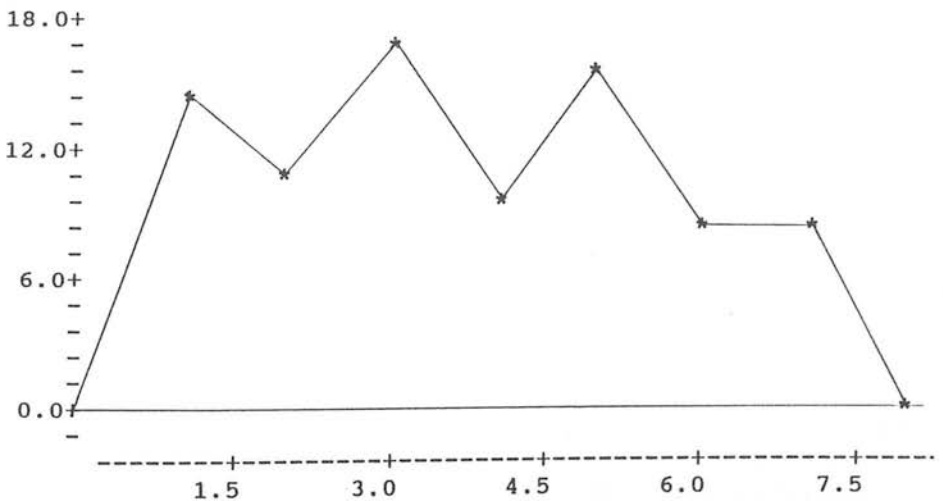
LEVEL  
1



LEVEL  
2



LEVEL  
3

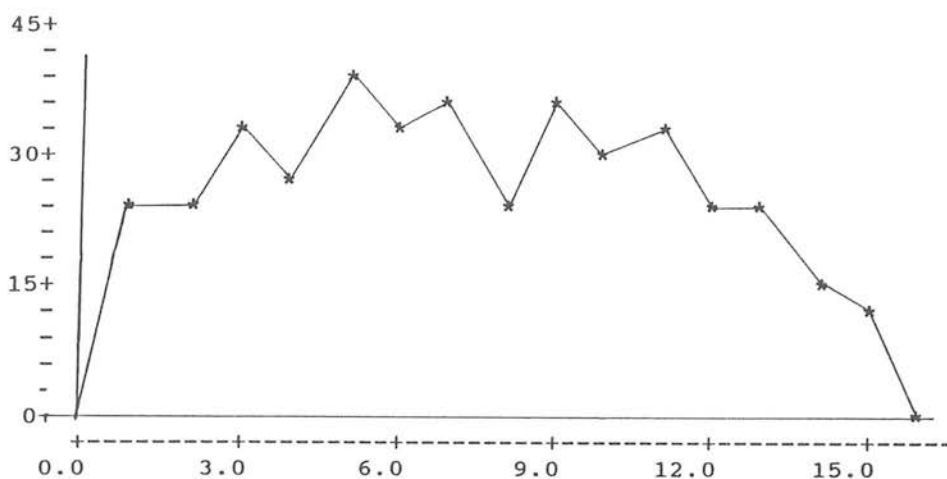


**Mathematical Model for the Pauline Epistles**

**Computer Version: Levels 1 - 3**

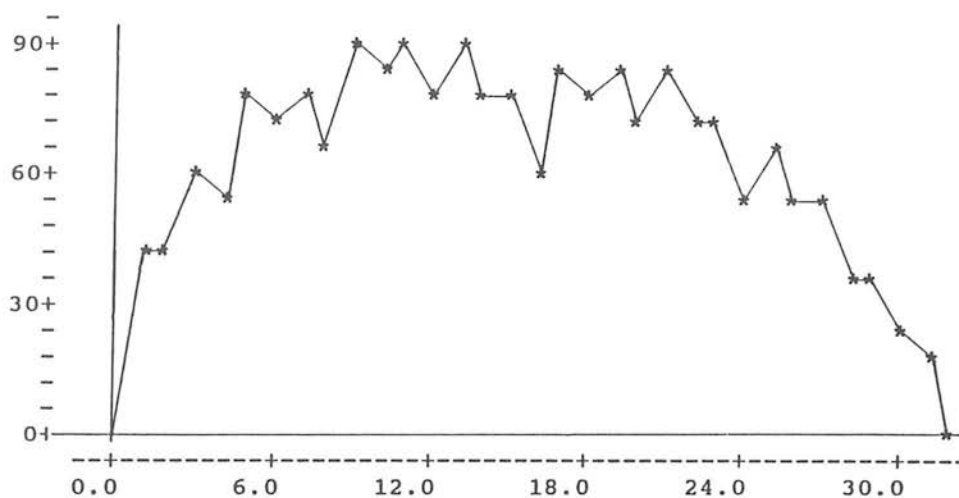
LEVEL

4



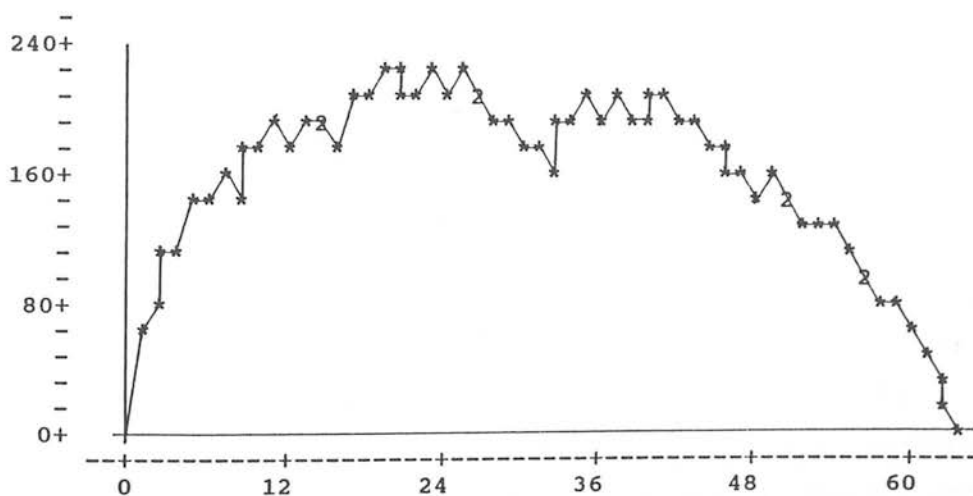
LEVEL

5



LEVEL

6



Mathematical Model for the Pauline Epistles

Computer Version: Levels 4 - 6



some surprise that these were found to produce schematics for Romans and Galatians. The figures for the whole model up to Level Six are shown on page 219. Computer versions of Levels Four to Six are shown on page 217. While the limitations of the computer programme are evident in these graphs, the "skewed symmetry" is clear. At every level the primary hinge point is in exactly the same central position. The "thrust" into the B section can be clearly seen, as can the skew resulting from the difference in scale between the A and B sections.

The Model is shown on page 220, correctly drawn out, with the various levels in different colours. It shows how the different levels relate to each other. They represent cumulative sum graphs of the sequences of numbers at each level (always beginning at the high end of the sequence). Each successive level retains the hinge point(s) of the previous level(s) and adds new secondary hinge points.

The pattern begins at Level One as a simple triangle, but at higher levels develops characteristics that are reminiscent of real "human" cumulative sum graphs. These levels represent particular points on an evolving scaling system. It is not to be expected that the graph of any letter will correspond exactly to any level of the model. The chances are against this happening, but the graph of each prime pattern will be found to lie near one or other of these levels, but also showing to some degree, the finer detail of the next level. Each prime pattern may therefore be placed within a scaling system which embraces all the Pauline epistles. None of the other authors studied provides any system remotely like this.

In matching the model to the cumulative sum graphs of the texts, what is being sought is not identity of shape and proportion, but a correspondence of features. It must be emphasised that this is just a rough fit, based on the punctuation of the UBS and Souter's versions. The preference of one or the other allows a very narrow range of choice, as the attempt is made to recover the pattern of pauses inherent in the text. Occasionally one of these versions will be very close to that pattern, and it is possible to "unstack" the letter in the way Philippians was examined, by taking the B section as an independent unit at each level. As a letter is unstacked in this way, the later sections take the form of successively lower levels of the model. This is seen in the graphs on page 221 where the computer graph of Ephesians is

SC3SYS.DAT - MATHEMATICAL MODEL FOR PAULINES BASED ON BASE 12/4 AND  
 INCREASED BY 50% EACH STEP AS LARGER STEPS ARE STACKED AGAINST SMALLER STEPS

(Note: 12/4 ratio was selected rather than 3/1 in order to keep figures within  
 three decimal places as the model was developed in the higher levels.)

	*	*	*	*	*	91.125	
	*	*	*	*	*	30.375	
	*	*	*	*	*	60.750	
	*	*	*	*	*	20.250	
	*	*	*	*	*	60.750	
	*	*	*	*	*	20.250	
	*	*	*	*	*	40.500	
	*	*	*	*	*	13.500	
	*	*	*	*	*	60.750	
	*	*	*	*	*	20.250	
	*	*	*	*	*	40.500	
	*	*	*	*	*	13.500	
	*	*	*	*	*	40.500	
	*	*	*	*	*	13.500	
	*	*	*	*	*	27.000	
	*	*	*	*	*	9.000	
	*	*	*	*	*	60.750	
	*	*	*	*	*	20.250	
	*	*	*	*	*	40.500	
	*	*	*	*	*	13.500	
	*	*	*	*	*	40.500	
	*	*	*	*	*	13.500	
	*	*	*	*	*	27.000	
	*	*	*	*	*	9.000	
	*	*	*	*	*	40.500	
	*	*	*	*	*	13.500	
	*	*	*	*	*	27.000	
	*	*	*	*	*	9.000	
	*	*	*	*	*	27.000	
	*	*	*	*	*	9.000	
	*	*	*	*	*	18.000	
	*	*	*	*	*	6.000	
	*	*	*	*	60.75	60.750	primary hinge
	*	*	*	*	20.25	20.250	
	*	*	*	*	40.50	40.500	
	*	*	*	*	13.50	13.500	
	*	*	*	*	40.50	40.500	
	*	*	*	*	13.50	13.500	
	*	*	*	*	27.00	27.000	
	*	*	*	*	9.00	9.000	
	*	*	*	*	40.50	40.500	
	*	*	*	*	13.50	13.500	
	*	*	*	*	27.00	27.000	
	*	*	*	*	9.00	9.000	
	*	*	*	*	27.00	27.000	
	*	*	*	*	9.00	9.000	
	*	*	*	*	18.00	18.000	
	*	*	*	*	6.00	6.000	secondary hinge
	*	*	*	40.5	40.50	40.500	
	*	*	*	13.5	13.50	13.500	
	*	*	*	27.0	27.00	27.000	
	*	*	*	9.0	9.00	9.000	
	*	*	*	27.0	27.00	27.000	
	*	*	*	9.0	9.00	9.000	
	*	*	*	18.0	18.00	18.000	
	*	*	*	6.0	6.00	6.000	
	*	*	27	27.0	27.00	27.000	
	*	*	9	9.0	9.00	9.000	
	*	*	18	18.0	18.00	18.000	
	*	*	6	6.0	6.00	6.000	
	*	18	18	18.0	18.00	18.000	
	*	6	6	6.0	6.00	6.000	
12	12	12	12	12.0	12.00	12.000	
4	4	4	4	4.0	4.00	4.000	
1	2	3	4	5	6	LEVEL	

# A MATHEMATICAL MODEL FOR THE PRIME PATTERNS IN THE PAULINE EPISTLES

LEVEL

1

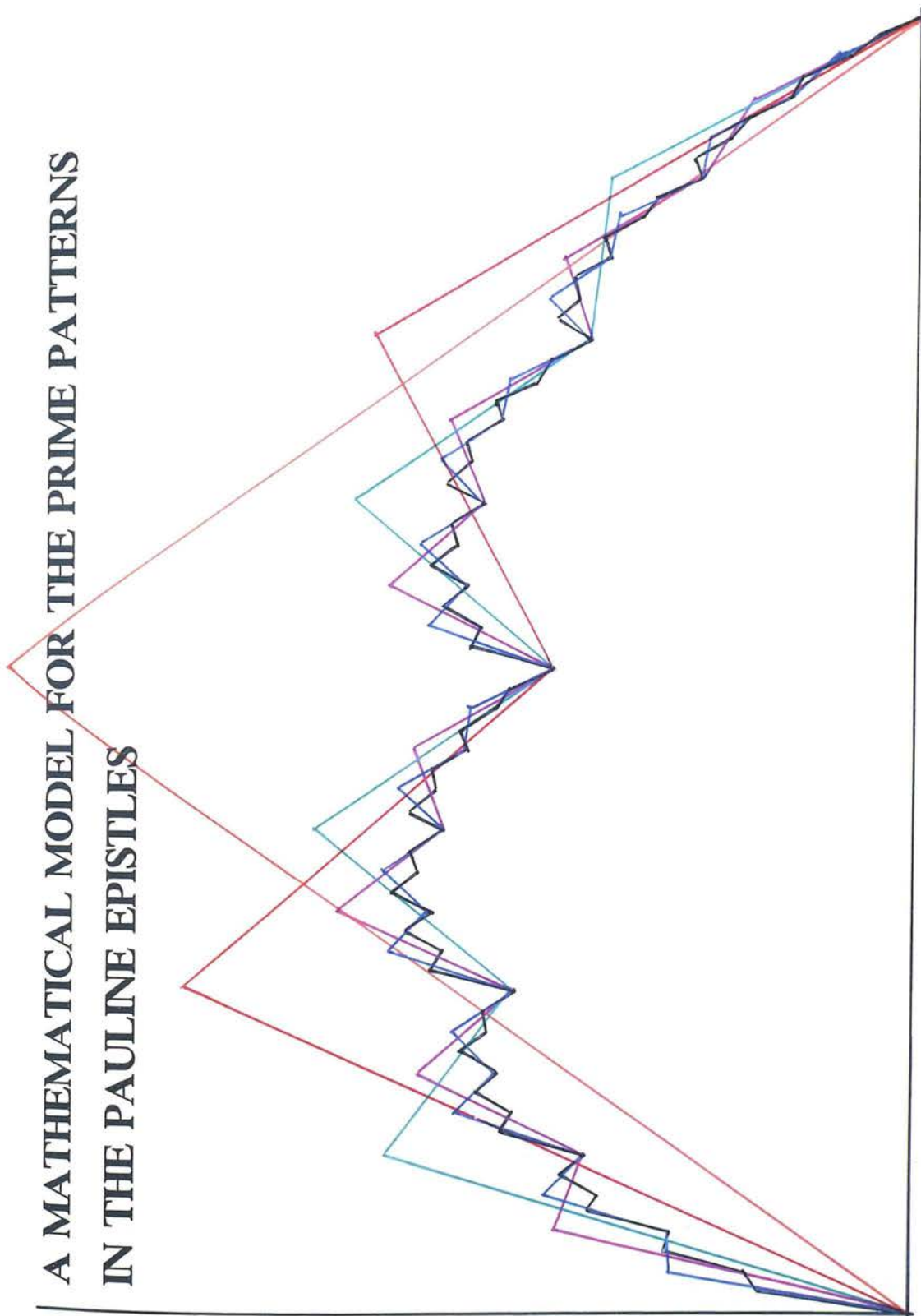
2

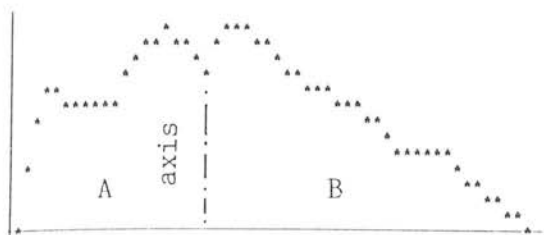
3

4

5

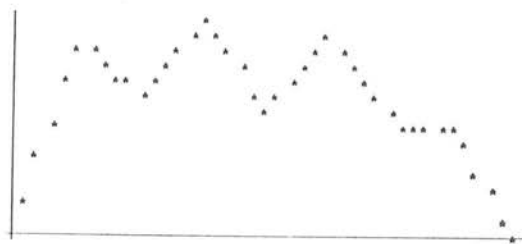
6





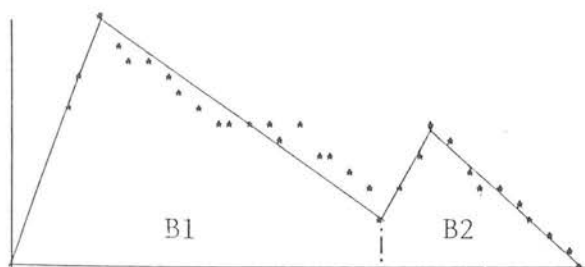
EPHESIANS 1:1 - 6:4

UBS TEXT ADJUSTED



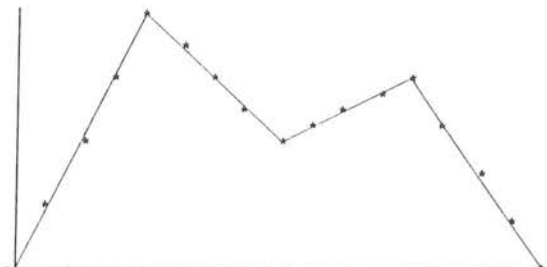
MODEL: LEVEL THREE

ADDITIONAL POINTS INTERPOLATED



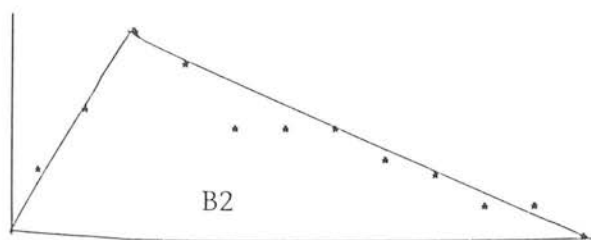
EPHESIANS 4:11 - 6:4

(SECTION B)



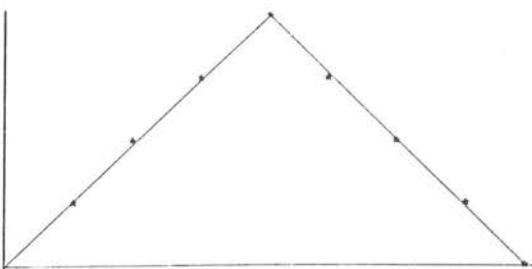
MODEL: LEVEL TWO

ADDITIONAL POINTS INTERPOLATED



EPHESIANS 5:18 - 6:4

(SECTION B2)



MODEL: LEVEL ONE

ADDITIONAL POINTS INTERPOLATED

compared with the computer graph of Level Three of the Model. The B section, taken as an independent unit is found to have the same topography as Level Two of the Model, and the B2 section, taken as an independent unit, corresponds to Level One. (These graphs are based on Ephesians 1:1 to 6:4 but I have since concluded that the prime pattern in Ephesians ends at the close of Chapter 5.)

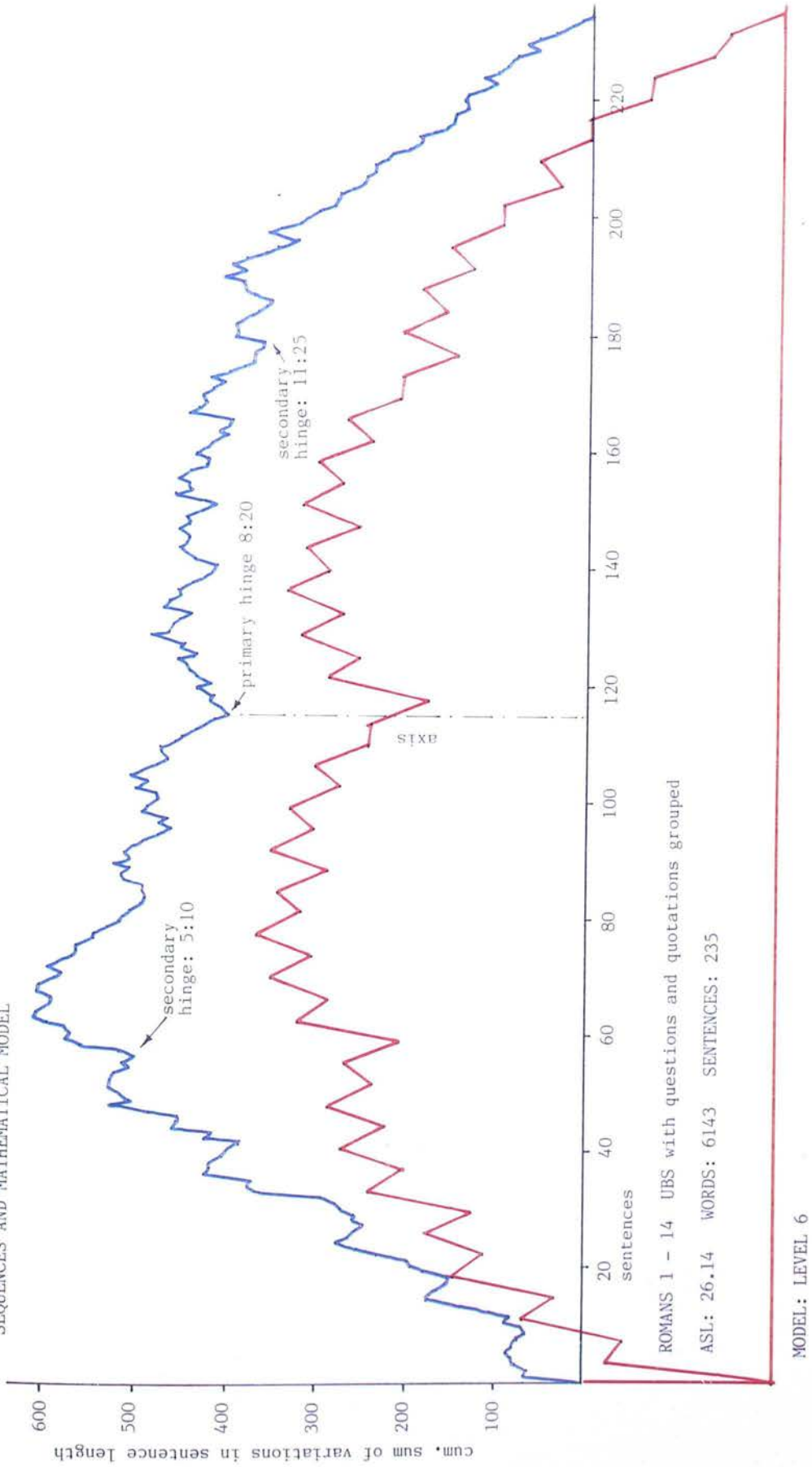
The Model was designed to mimic the main features which constantly recur in Pauline epistles, despite differences in scale and ASL. It was not intended to reproduce the fine detail of the sentence sequences. In arriving at the formula, no account was taken of differences in contrast, which depend largely upon mood, and which result in variations in the heights of the graphs. The choice of scales in drawing out the model is an arbitrary one, and in order to compensate for differences in contrast, the height of the graph of the model has been more or less matched to the height of the graph of the epistle. In most cases, a sentence ratio of 12/4 and a section ration of 1.5:1 have been used. In the case of Romans, a sentence ratio of 12/3 and a section ratio of 1.33:1 enhanced the small detail to give a closer resemblance to the opening cyclic sequences. Occasionally, where the contrast was found to be very high, as in 2 Thessalonians, a sentence ratio of 2/1 and a section ratio of 1.25:1 were used and the graph drawn on a logarithmic scale. These variations in values compensate for variations in the proportions of the sentence sequence graphs which are due to mood. The underlying scaling construction follows the same system throughout.

### 5.4.1 Romans

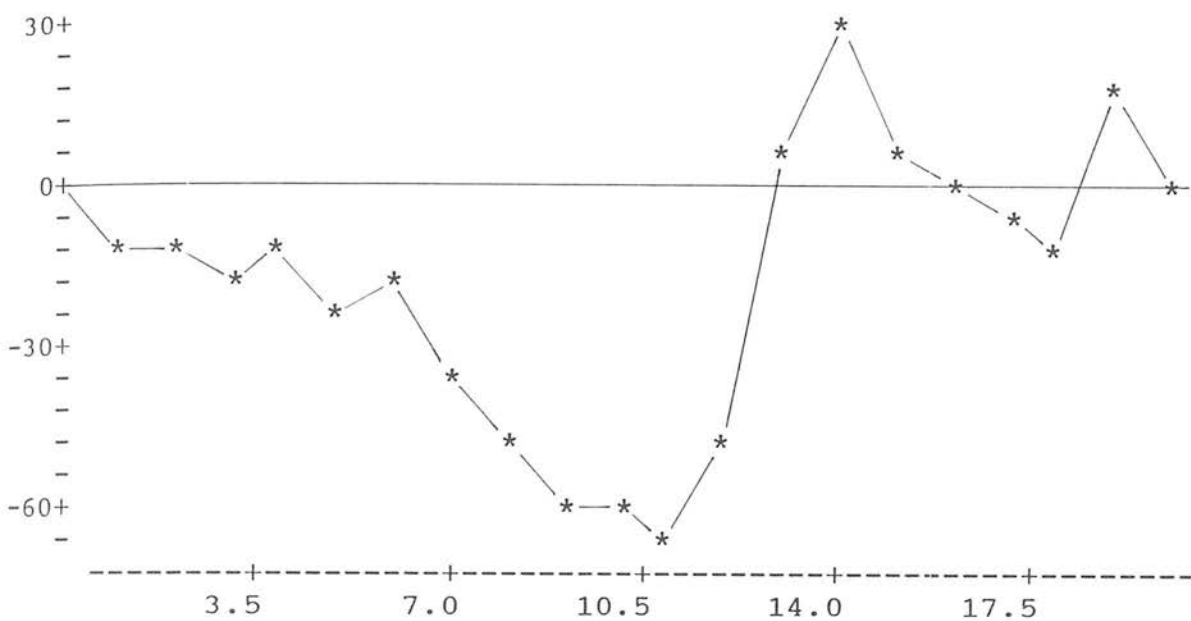
The prime pattern in Romans (page 224), covers the first fourteen chapters with an ASL (after adjusting questions) of 26.14 words. Chapters 15 and 16 form two separate afterthoughts written on different scales with ASLs of 27.15 and 15.7 words respectively. Graphs of these chapters are shown on page 225. I would consider that the prime pattern in Romans represents material which Paul prepared in his mind and dictated in one operation. It is the longest prime pattern and must be something of a tour de force on Paul's part. If dictation of the prepared material stopped at the end of Chapter 14 and Paul continued with spontaneous material, then the ASL of the afterthought material might be expected to be consistent with that of the last part of the prime pattern. That is what is found in Ephesians and Galatians. But if, after a lapse of time, Paul returned to finish the letter, an ASL comparable with that of the whole prime pattern might be expected. Chapter 15 provides such an ASL, but the sentence sequence pattern is indeterminate: it does not show the pronounced features which would be expected in an independent piece, and it would be most appropriate to regard Chapter 15 as a continuation of Chapter 14 after a break in the dictation. Chapter 16 consists of greetings and has an appropriately low ASL. The long Doxology at the end of Chapter 16 is seen clearly on the graph on page 225.

These patterns may be related to the debate concerning the last two chapters of Romans. C.K. Barrett in his *Commentary on the Epistle to the Romans* [19, pp. 9-13] summarises the positions occupied by the Grace and the Doxology. The Grace occurs variously at 16:20b and at 16:24 but is omitted in some important texts. The Doxology may be found in various texts at the end of Chapters 14, 15 or 16. Barrett is content to show how permutations of the sections represented by 1-14, 15 and 16 produced the different forms which are found in the various MSS. T. W. Manson [43, pp. 1-16] considered the possibility that an original corresponding to 1-15 had been sent to Rome, and a further copy with the greetings of Chapter 16 added, sent to the congregation in Ephesus. Further versions represent intermixtures of these types of text with Marcion's version which ended at 14:23.

COMPARISON OF GRAPHS OF SENTENCE  
SEQUENCES AND MATHEMATICAL MODEL

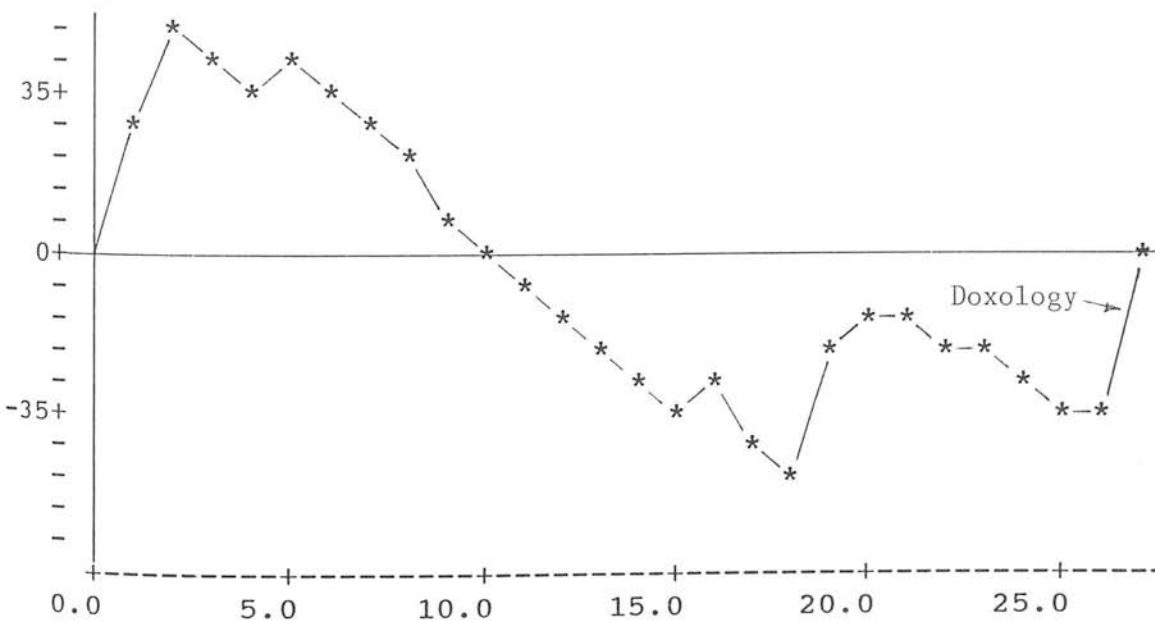






ROMANS CHAPTER 15 UBS

ASL: 27.15 WORDS: 543 SENTENCES: 20



ROMANS CHAPTER 16 UBS

ASL: 15.70 WORDS: 424 SENTENCES: 27

The problem posed by punctuation is at its most acute in the Epistle to Romans. Questions account for about 25% of the sentences in the UBS text, and must be grouped to obtain a text which is homogeneous in respect of scale. Three methods have been employed, firstly, that used in 1965 when I attempted to divide the text into word groups, respecting scale, but without reference to the punctuation of modern versions; secondly, by grouping questions in the modern texts with reference to syntax and content; thirdly, by grouping questions with adjoining text in a mechanical way to form groups as near as possible to the ASL of the section, thus neutralising the effect of the short questions. All three methods produced the same kind of high graph with features that are found in the mathematical model (see page 192 for the second and third methods). The matter of dealing with short questions is therefore not as critical as it first seemed in recovering the basic underlying scaling structure. The graph obtained by considering syntax and content has been selected for comparison with the model, and this is shown on page 224. Lists of sentence lengths showing the grouping of questions (in brackets) and quotations (in square brackets) are given on pages 227f. Different interpretations are possible in grouping the questions, but provided that the resulting groupings tend towards the ASL then the main features of the scaling pattern will appear.

For the comparison between the graphs of the prime pattern and the Model Level Six on page 224, the version of the model selected is based on the numbers 12/3 and the ratio 1.33:1, as this exaggerates the sawtooth pattern, giving a closer likeness to the graph of the opening cycles of the letter. The hinge points remain in exactly the same position in all versions of the model. The primary hinge and the principal secondary hinges on the graphs of both the model and the letter are clear. The "thrusts" formed by the long sentences immediately following these hinge points are linked thematically - the saving of the Christian, the saving of the creation, and the saving of the people of Israel.

The first is at 5:10 and reads:

*For if while we were enemies we were reconciled to God by the death of his Son, much more, now that we are reconciled, shall we be saved by his life. (RSV)*

ROMANS 1-14 - U.B.S. punctuation.

1:1	93		4?		2?
	21		1		9?
	42		3?		2
	29		2?		21?
	30		5		26
	21		8		8
	19		5?		26
	18		3?		10
	32		17		5?
	45		6?		9
	22		5		21
	45				19
	57	4:1	10?		
	69		12		17?
			5?	7:1	20
2:1	22		10		29
	15		62		26
	21?		12?		44
	23?		9		3?
	55		3?		3?
	39		6?		24
	29		58		18
	60		21		41
	56?	Take 2:17-20 (49)	25		13
	5?	and 2:21-24 (47)	56		6?
	5?		68		24
	5?		6		15
	25		39		16
	17				12
	16?	5:1	38		12
	17		23		38
	39		21		18
			12		53
3:1	12?		33		12?
	4		15		10
	9		42		15
	2?		68		
	12?		39		
	26		24	8:1	28
	10?		33		46
	8?		45		16
	3		39		41
	9?				15
	21?	6:1	3?		11
	18?		7?		17
	5		2		31
	2?		9?		28
	1?		13?		9
	30		27		18
	13		41		11
	40		22		16
	8		13		17
	39		17		12
	25		42		34
	74		13		36

	15?}		7?}		13
	9 }		6?}		5
	41		5?}		36 }
	16		6?}		22 }
	37		10 }		12
	5?}		6 }	13:1	5
	8?}		9?}		15
	22?}		11		16
	5?}		5?}		12
	6?}		18 }		22
	19 }		6?}		23
	8?}		14 }		13
	13?}		17 }		14
	13 }		17		23
	9				15
	40	11:1	9?}		28
			12 }		12
9:1	25		9		21
	60		16?}		7
	9		17 }		12
	21		6?}		31
	19		10 }		
	15		24	14:1	10
	55		2?}		10
	3?}		35 }		20
	5?}		33 }		7?}
	2 }		6?}		14 }
	13 }		14 }		18
	12		18		26
	29		28		22
	9		15?		10
	7?}		16		13
	6?}		38		7?}
	10?}		7		8?}
	10?}		9		24 }
	22?		20		10
	37?		24		16
	47		16		20
	31		25		22
	20		45 }		6
	3?}		12 }		33
	22 }		24		13
	2?}		26		8
	31 }		12		11
			18		15
			5?}		10
			5?}		26
			7?}		
			18		
10:1	17	12:1	50		
	29		31		
	9		31		
	17		46		
	18?}		3		
	10?}		42		
	6 }		8		
	3?}		6		
	22 }				
	33 }				
	11				
	28				

The second, at the primary hinge, is at 8:20 and reads:

*For the creation was subjected to futility, not of its own will but by the will of him who subjected it in hope; because the creation itself will be set free from its bondage to decay and obtain the glorious liberty of the children of God. (RSV)*

The third, at the latter secondary hinge, is at 11:25 and reads:

*Lest you be wise in your own conceits, I want you to understand this mystery, brethren: a hardening has come upon part of Israel, until the full number of the Gentiles come in, and so all Israel will be saved; as it is written, "The Deliverer will come from Zion, he will banish ungodliness from Jacob"; "and this will be my covenant with them when I take away their sins." (RSV)*

One could go further and select tertiary hinges with appropriate "thrusts" at 2:28, 7:5, 10:6 and 13:9 which are all key texts. In this present study there is no need to go beyond the first three quoted above in order to show the general correspondence to the model and to the scaling system. I do not want to press this unduly, though there is a very strong rhythmic construction running right through these fourteen chapters.

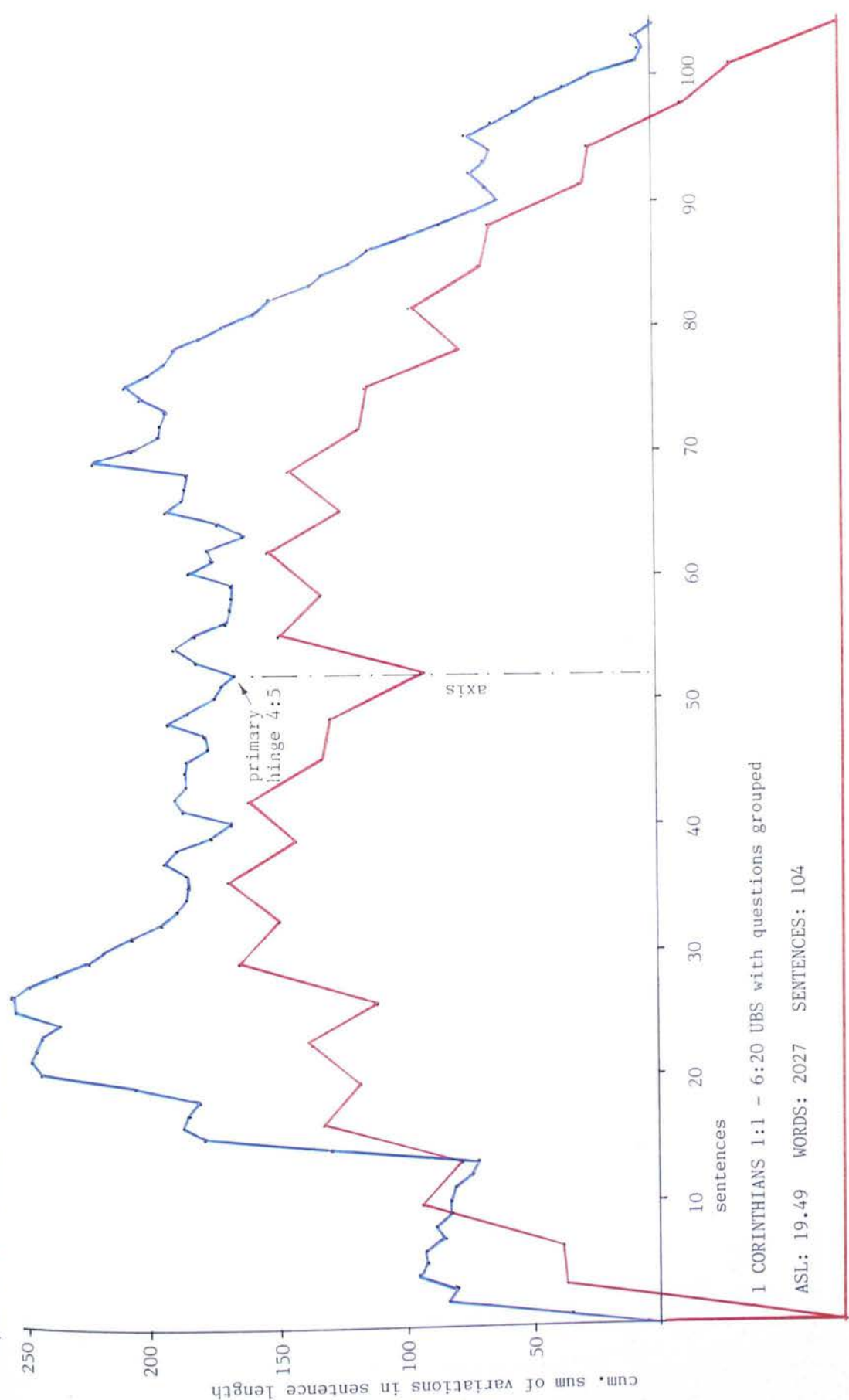
The model solves the problem of the initial "steps" in the Pauline graphs. It was not clear whether these were to be regarded as an opening feature in Paul's letters, or whether they formed part of a continuous pattern running through the entire letter. The model shows clearly that they are part of a continuous rhythm which extends throughout prime patterns. The axis of symmetry is seen running through the primary hinge. The extent of the "thrust" into the B section is not very clear, but if it is taken to correspond with the section in UBS entitled "The Glory That is to be" (8:18-30), then it is preceded by 113 sentences with a greater ASL and followed by 114 sentences with a lower ASL, thus exhibiting the typical Pauline "skewed symmetry" (page 201).

### 5.4.2 1 Corinthians

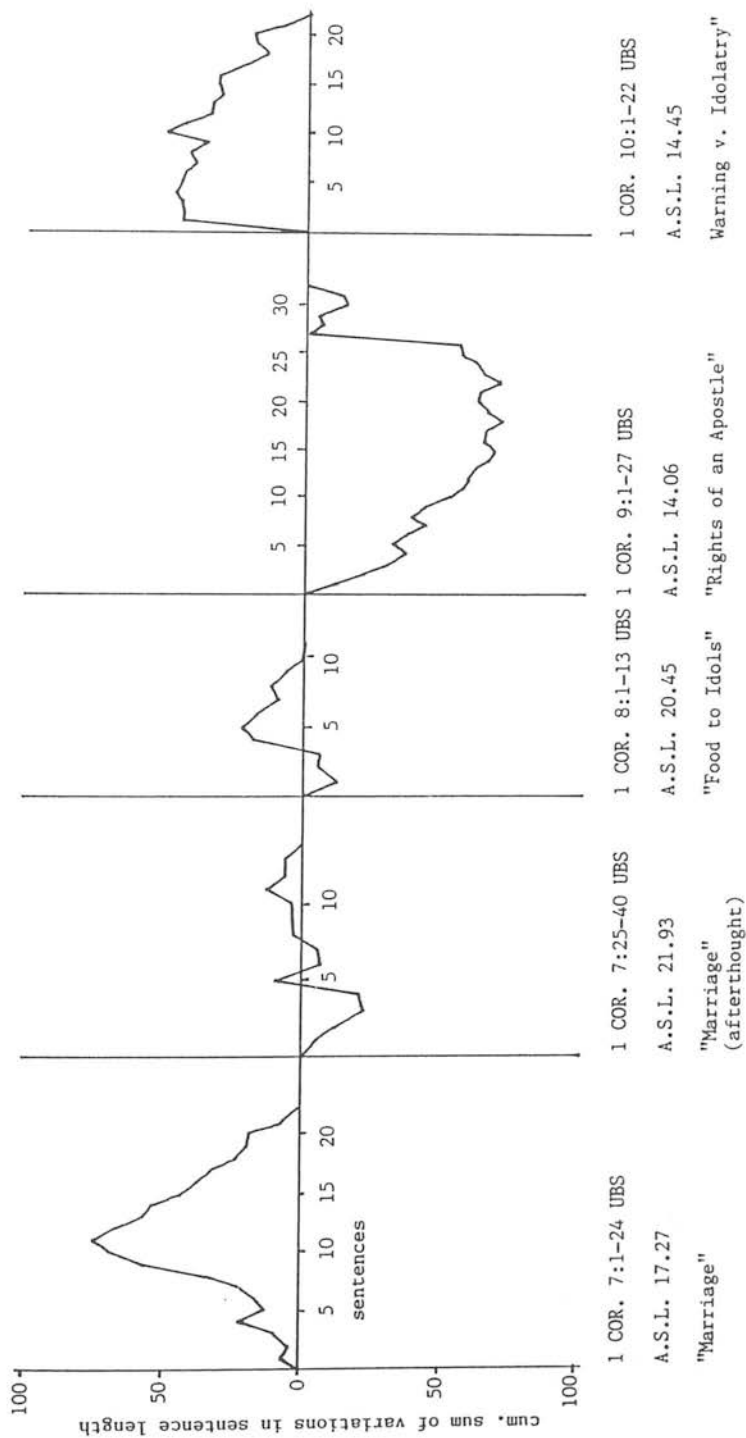
Chapters 1 - 6 form the opening prime pattern. Chapter 7 begins, "Now concerning the matters about which you wrote...", and the remainder of the letter consists of a series of topics which are reflected in the sentence sequence graph as individual pieces. The whole pattern is shown on page 194. The graph of Chapters 1 - 6 is compared on page 231 with Level Five of the Model. The graphs of the topics in Chapters 7 - 13 are shown on pages 232ff.

Some adjustment is required in Chapters 1 - 6, and the list of sentence lengths is given on page 235, with the groupings indicated. The symmetry about the axis is clear, and the primary hinge occurs at 4:5 which is the key verse about judgement. This verse marks the transition, from section A which is concerned with the apostle's task in preaching Christ, to section B which is concerned with the behaviour of the Corinthians. The "thrust" at 4:5,6 is preceded by 52 sentences with a higher ASL and followed by 50 sentences with a lower ASL. While the symmetry is clear, I would not pursue the recognition of too much fine detail. The overall rhythm is strong, but it is less even than in Romans. Secondary hinges might be located at 2:12 - "We have received ...the Spirit" - and at 5:9 - "I wrote to you not to associate with immoral men..." The importance of these chapters is that they provide the typical skewed symmetry, and give a plausible picture of Paul preparing so much material in his mind, dictating it, and then going on to answer the various questions raised by the Corinthians. It is not necessary to reject the evidence of 7:1 and to envisage the insertion of material by other hands.

The text of Chapters 7 - 16 is divided into fifteen sections. These have been taken as separate pieces and ASLs calculated for each one. No grouping of questions or sentences is required. These sections vary in scale considerably, from final greetings with an ASL of 10.17 words to the passages on love and an afterthought on marriage with ASLs of over 20 words. The least typical section is found in 9:1-27 where Paul defends his rights as an apostle. He asks 17 questions within 32 sentences. This little graph is almost the reverse of a normal Pauline pattern; if the graph is turned upside down it looks distinctly Pauline in form and proportion. The

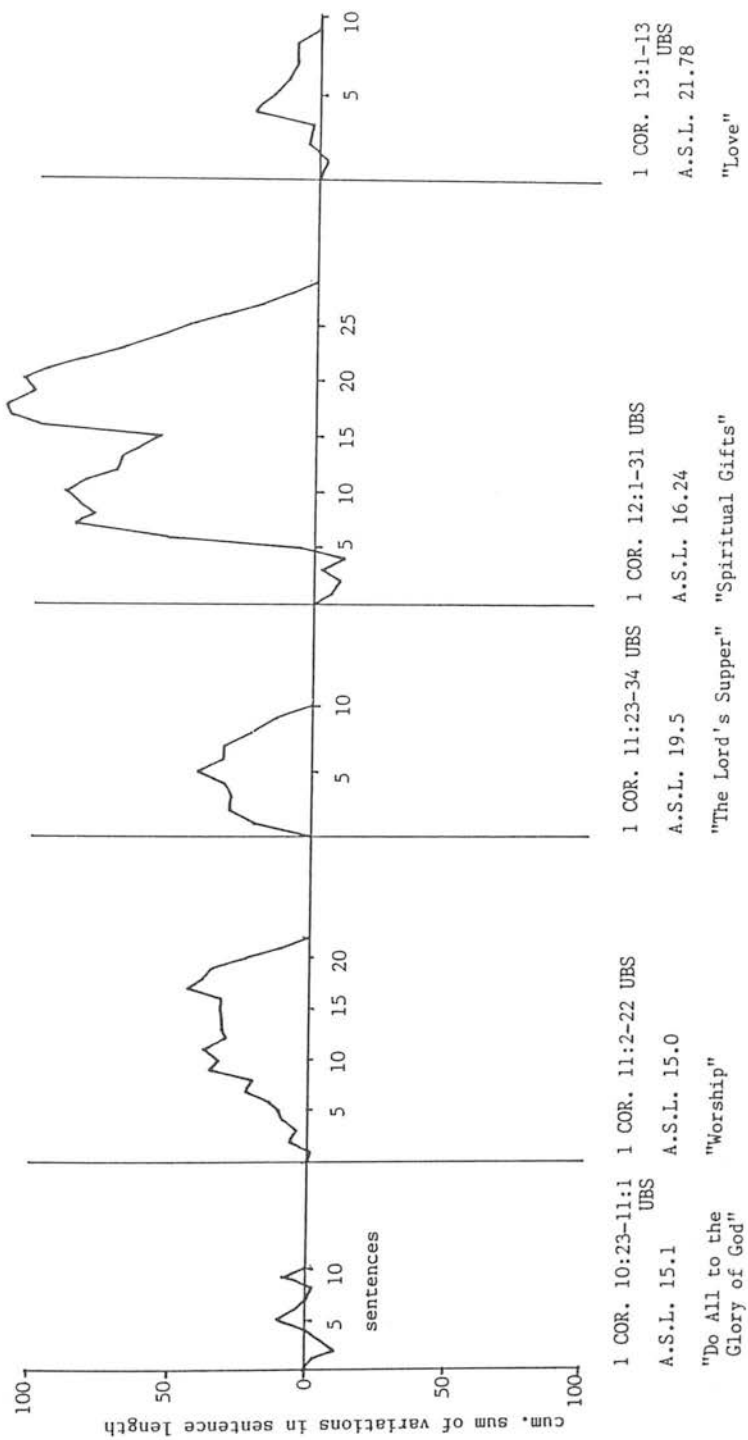






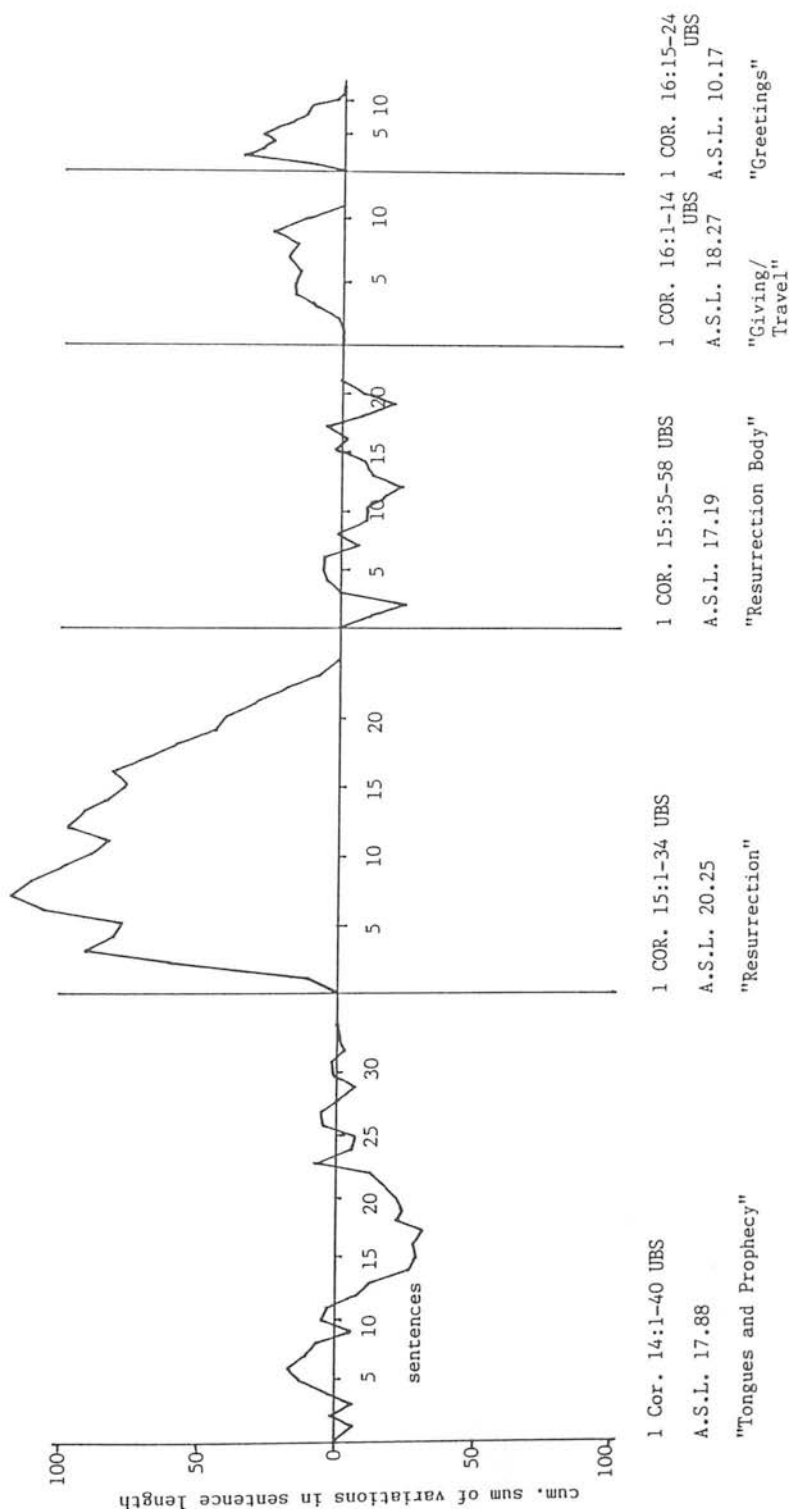
1 CORINTHIANS 7:1 - 10:22 UBS

CUMULATIVE SUM GRAPHS OF SENTENCE SEQUENCES



1 CORINTHIANS 10:23 - 13:13 UBS

CUMULATIVE SUM GRAPHS OF SENTENCE SEQUENCES



1 CORINTHIANS 14:1 - 16:24 UBS

CUMULATIVE SUM GRAPHS OF SENTENCE SEQUENCES

1 CORINTHIANS 1-6 - Adjustment of UBS punctuation.

1:1	55	4:1	11	8
	68		10	8
	16		17	3
	35		15	18
	15		33	22?
	20		29	11
	3?}		4?}	
	11?}		6?}	
	22		9?	
	13		17	
	19		20	
	18		19	
	13		35	
	2?}		11	
	2?}		21	
	5?}		6	
	8?}		29	
	78		39	
	68		2?}	
	28		11?}	
2:1	18	5:1	19	
	14		18?	
	45		56	
	56		5	
	24		9?	
	18		18	
	16?		18	
	13		29	
	39		26	
	21		6?}	
	11		5?}	
	8?		6 }	
	5		6 }	
3:1	15	6:1	17?	
	8		9?	
	9		11?	
	14?		7?	
	15?		13?	
	4?}		4	
	4?}		15?	
	10		9?	
	21		12	
	27		5?	
	16		5?	
	5		8	
	13		9?	
	37		25	
	23		24	
	14?		16	
	21		17	
	19		28	
	11		9?	
	21		9?}	
	33		2 }	
			11?	

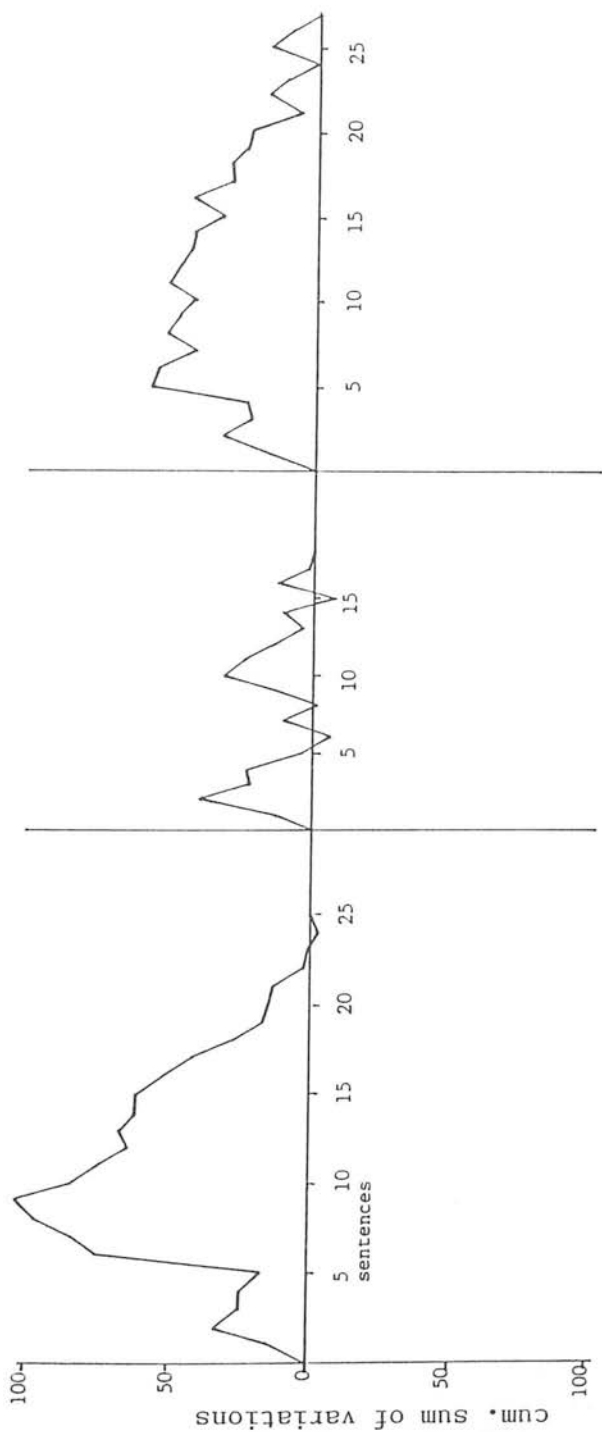
graphs of other topics show a skewed symmetry, even though they are very small. The first, 7:1-24, on marriage, is comparable with Philemon in structure. The few verses on the Lord's Supper, 11:23-34, are symmetrical. The passage on spiritual gifts, 12:1-31 provides symmetry and a typical notched form. The passage on resurrection, 15:1-34 is a miniature but classic Pauline pattern, and its shape is later compared with those of Ephesians and Colossians (pages 254f.). These small topical patterns may therefore give evidence of Paul having thought through the material and having his response ready; in such cases a small but well formed pattern appears. Other undistinguished patterns suggest that on these points he is speaking spontaneously in response to a question raised by the Corinthians.

### 5.4.3 2 Corinthians

The first nine chapters of 2 Corinthians provide a series of small patterns which are related to topics. These are shown as individual pieces on pages 238f. No adjustment has been made to the UBS text in respect of questions or quotations. The short passage, 6:14 - 7:1, has been extracted from its context and is shown separately. Reference to Kümmel [36, p. 287] shows that its authenticity has often been challenged. It provides an odd pattern, but is too short to allow of any conclusion regarding its shape. All the other sections, except 2:12 - 3:18 provide a basic contrast between over average sentences at the beginning and under average sentences towards the end. The first section of 25 sentences provides a pattern of the Philemon type. These sections showing the basic contrast all correspond exactly with the sections of the text in UBS.

The prime pattern is found in 2 Corinthians 10:1 - 12:19a or thereabouts. On page 209 it was argued that the prime pattern ends at the end of 12:19, and the beginning of the letter was reconstructed by supplying two sentences, one of salutation and one of thanksgiving. The graph on page 240 shows an earlier and slightly different interpretation, with the pattern ending at 12:19a and one long verse (shown in dashes on the graph) matching 1 Corinthians 1:1 being added at the beginning. In both cases, the essential skewed symmetry is recovered, and the primary hinge, and the thrust formed by the list of Paul's sufferings, are clearly visible. It is worthy of note that the list of sufferings is an essential part of the prime pattern and is not to be regarded as an addition. Some questions must be grouped: the extreme case is found at 11:22 where the pattern 2? - 1 - 2? - 1 - 3? - 1 is found. The sentence list on page 241 shows these groupings and also groupings of very short sentences.

Chapter 13 forms an afterthought, indicated by the repetition of 12:14a - "This is the third time I am coming to you." The last verse or two of Chapter 12 are transitional, as Paul resumes dictation, and Chapter 13 provides the expected contrast between an opening thrust and the closing shorter sentences. The graph is shown on page 242.



2 COR. 1:1-2:11 UBS

A.S.L. 26.32

"Paul's Visit"

2 COR. 2:12-3:18 UBS

A.S.L. 22.83

"Ministers of the New Covenant"  
 "Treasure in Earthen Vessels"  
 "Living by Faith"  
 "Ministry of Reconciliation"

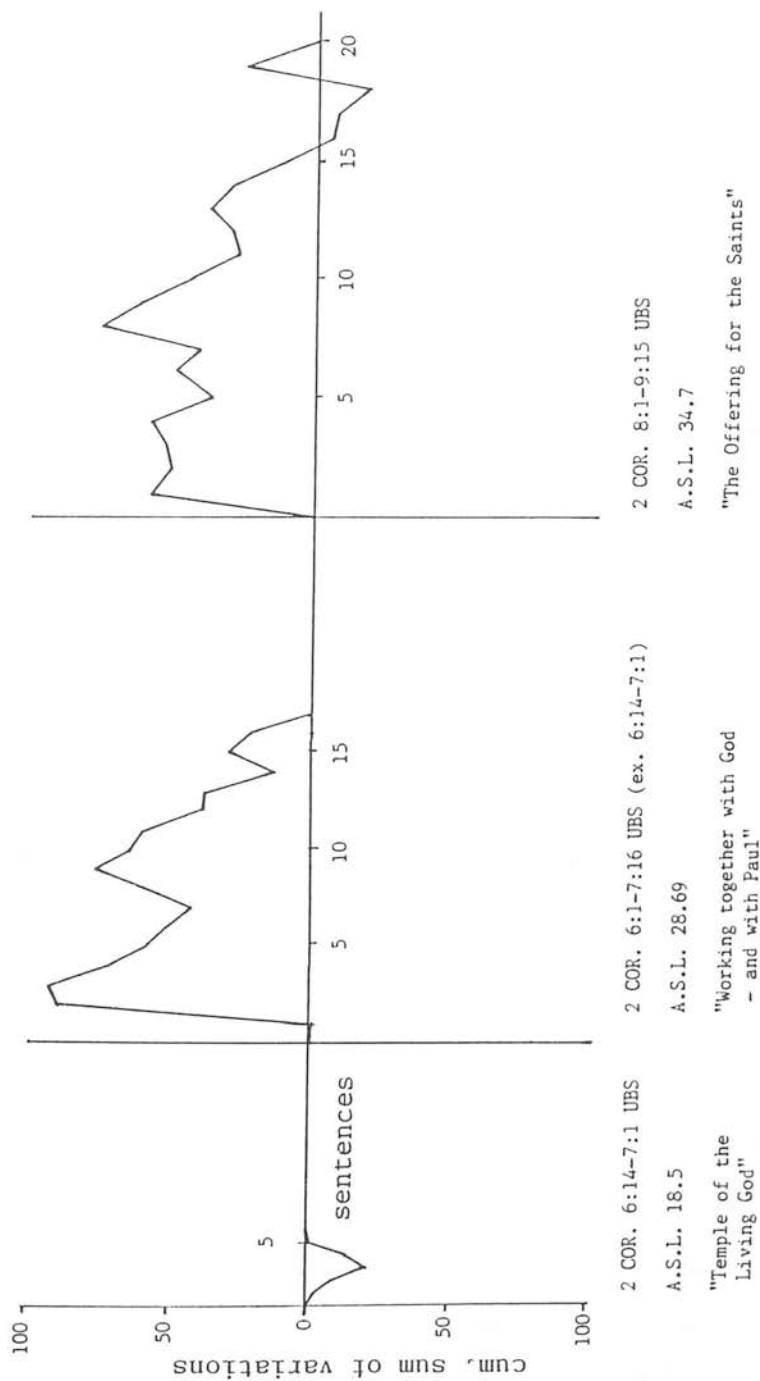
2 COR. 4:1-5:21 UBS

A.S.L. 24.46

2 CORINTHIANS 1:1 - 5:21 UBS

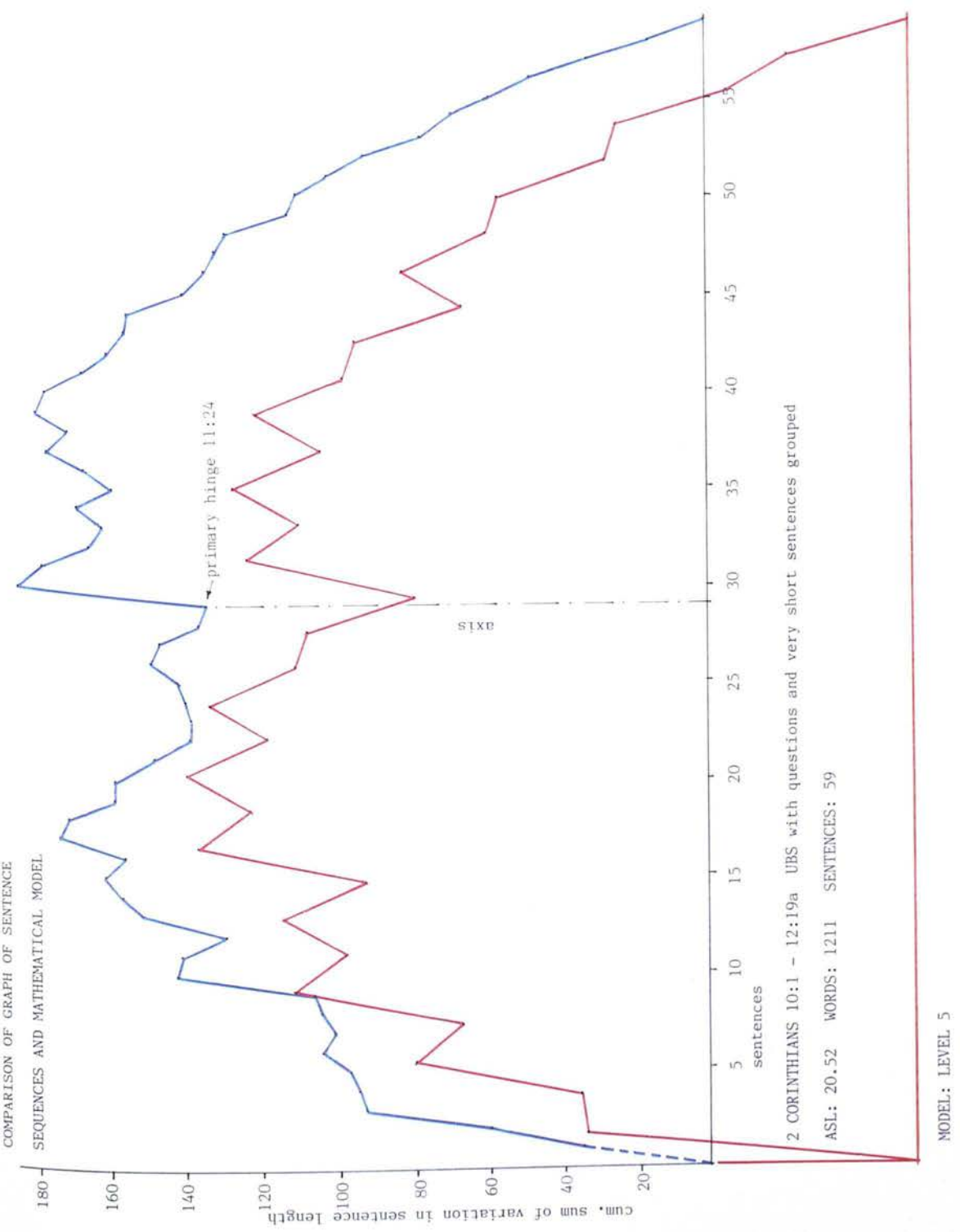
CUMULATIVE SUM GRAPHS OF SENTENCE SEQUENCES





2 CORINTHIANS 6:14 - 9:15 UBS

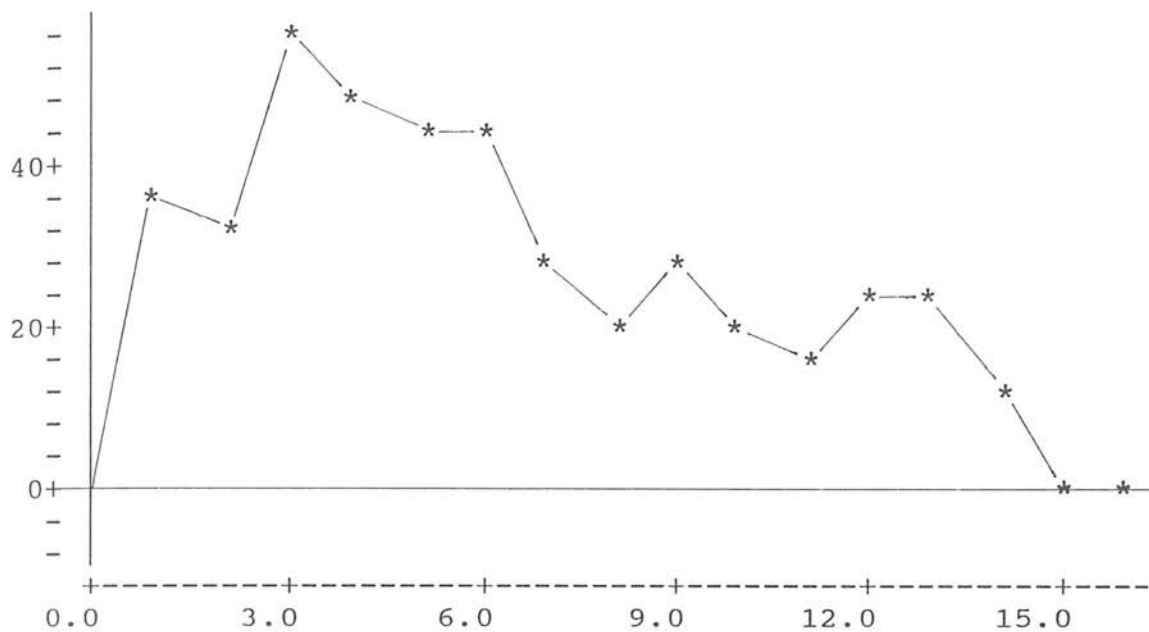
CUMULATIVE SUM GRAPHS OF SENTENCE SEQUENCES



2 CORINTHIANS 10:1 - 12:19a UBS with questions and very short sentences grouped  
ASL: 20.52 WORDS: 1211 SENTENCES: 59

2 CORINTHIANS 10:1 to 12:19a.

	<u>55</u>	(Additional sentence to compensate for lost beginning.)	
10:1	45		
	55	12:1	12
	4 }		27
	18 }		31
	23		14
	28		31
	17		17
	23		10
	23		14
	56		16
	19		20
11:1	10		5
	42		16
	26		17
	7 }		17?
	18 }		5
	16?		18
	37		13
	18		10
	2? }		6?
	4? }		12
	3 }		10?
	20		10?
	10		5?
	11		4?
	20		5
	22		
	16 }		
	7 }		
	28		
	7 }		
	11 }		
	2? }		
	1 }		
	2? }		
	1 }		
	3? }		
	1 }		
	3? }		
	16 }		
	73		
	5?		
	6?		
	8		
	17		
	27		



2 CORINTHIANS 12:20 - 13:13 UBS

ASL: 18.12    WORDS: 290    SENTENCES: 16

#### 5.4.4 Galatians

As noted on page 206, the prime pattern in Galatians extends from 1:1 to 5:15. A few short questions require to be grouped and these are shown on page 244. Quotations are absorbed into the text and no adjustment is needed. Comparison is made with Level 5 of the Model on page 245, and the afterthought from 5:16 - 6:18 is shown on page 247.

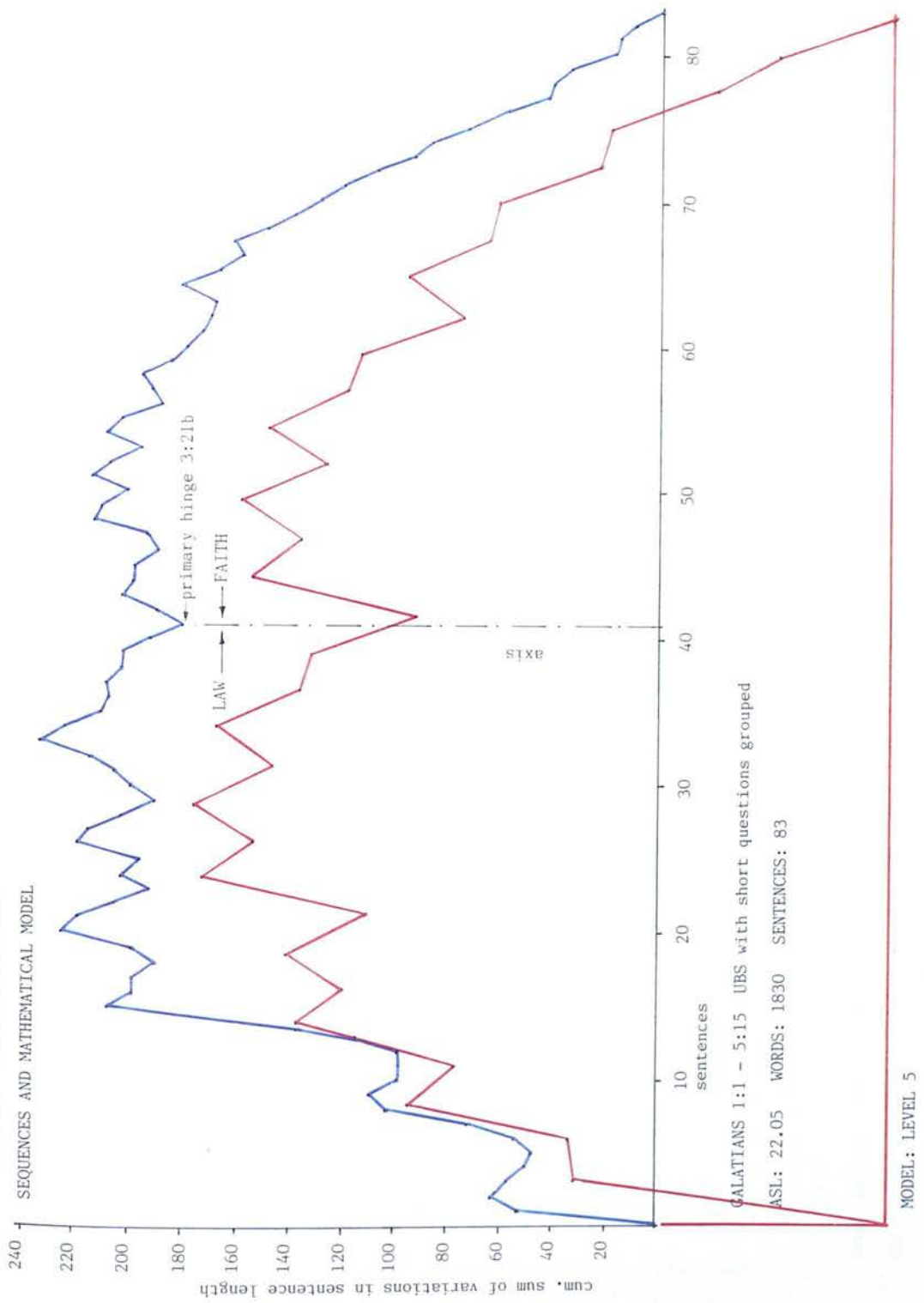
Romans and Galatians were chosen to examine whether there might be widespread corruption of the text through the insertion of glosses. Romans has a great number of questions widely distributed through the text. It is unlikely that questions would be inserted at a later date, and the deletion of portions of the text in areas which have few questions, disturbed the symmetry which was clearly there. The widest selection of possible insertions in Galatians is found in Professor J.C. O'Neill's book, *The Recovery of Paul's Letter to the Galatians* [52]. The suggested glosses were removed from the prime pattern, and the resulting sentence sequence graph is shown on page 246. As the possible glosses are dispersed throughout the epistle, the general contrast was not affected greatly; indeed it increased slightly. The opening cyclic pattern was somewhat disturbed and assumed a less likely form. The primary hinge, so far as it could be determined, lay in the middle of a section. There was no clear thrust into the B section. This is in marked contrast to the location of the primary hinge in the graph of the full text, where the hinge forms a very clear division between sections on the Law and on Faith.

These graphs were not designed to identify small glosses, although, as will be seen in the sections on 2 Timothy and Titus, they may on occasion point to inserted material. They were designed to identify the prime patterns, and there may well be unidentified glosses in the text. The UBS text of Galatians, with questions adjusted, provides a graph which bears a fair resemblance to Level Five of the Model, while the graph derived from the text with possible glosses removed tends to look more like a lower level of the Model. As the insertion of aphorisms would be more likely to degrade the scale pattern, rather than create a likeness to the higher level of the Model, I tend to favour retention of the text as it stands.

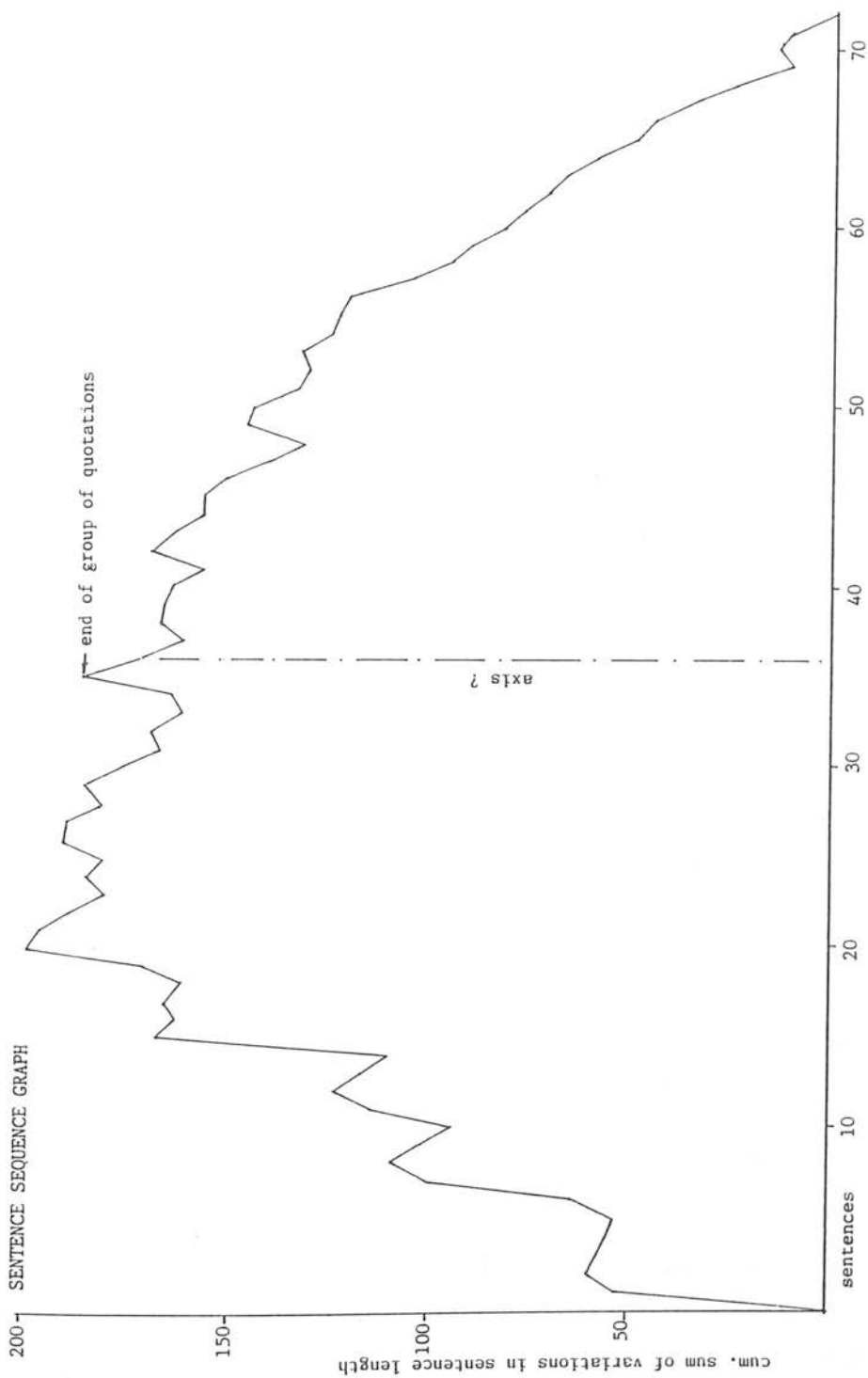
GALATIANS 1:1 to 5:15 - U.B.S. punctuation.

1:1	74	4:1	26
	33		41
	16		20
	15		13
	7?}		35?
	4?}		16
	9 }		10
	29		35
	39		5?}
	54		12 }
	28		6?
	11		26
	22		26
	22		11?
			16
2:1	39		16
	44		19
	93 (parenthesis)		20
	13		35
	22		8
	14		14
	30?		5?}
	47		20 }
	14?}		9
	2 }	5:1	13
	10		12
	9		13
	33		10
	15		8
			15
3:1	13?}		9
	16?}		7
	8?}		6
	3?}		20
	4 }		10?}
	18?		6 }
	10		20
	10		16
	31		11
	29		
	30		
	41		
	12		
	10		
	19		
	23		
	17		
	4?}		
	17 }		
	11		
	10		
	32		
	35		
	18		
	23		
	12		

COMPARISON OF GRAPH OF SENTENCE  
SEQUENCES AND MATHEMATICAL MODEL

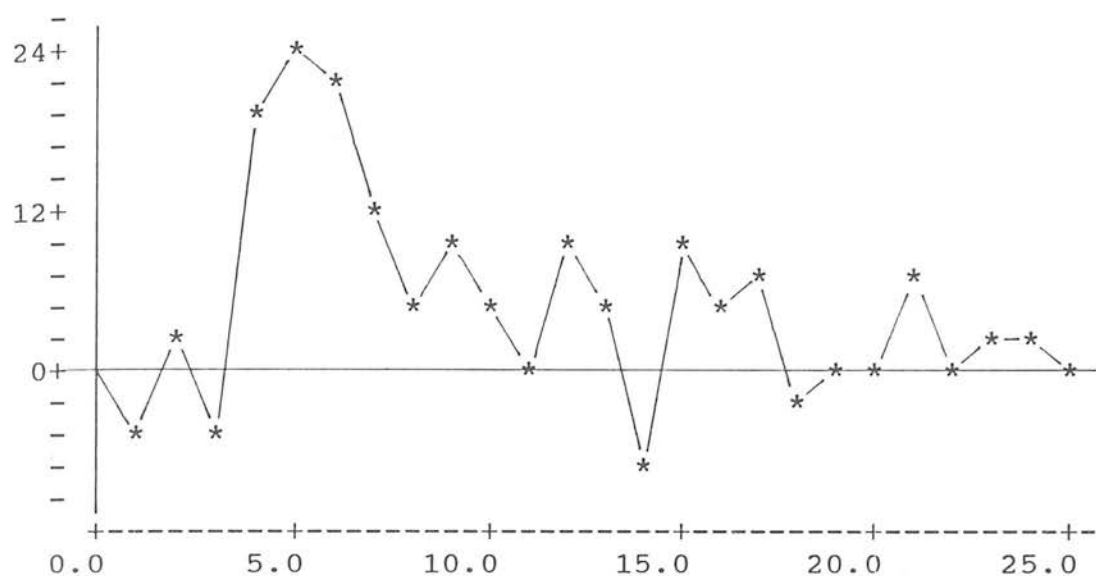






GALATIANS 1:1 - 5:12 Questions grouped and possible glosses removed. UBS text.

ASL: 18.1 WORDS: 1303 SENTENCES: 72



GALATIANS 5:16 - 6:18 UBS

ASL: 15.92    WORDS: 398    SENTENCES: 25

### 5.4.5 Ephesians and Colossians

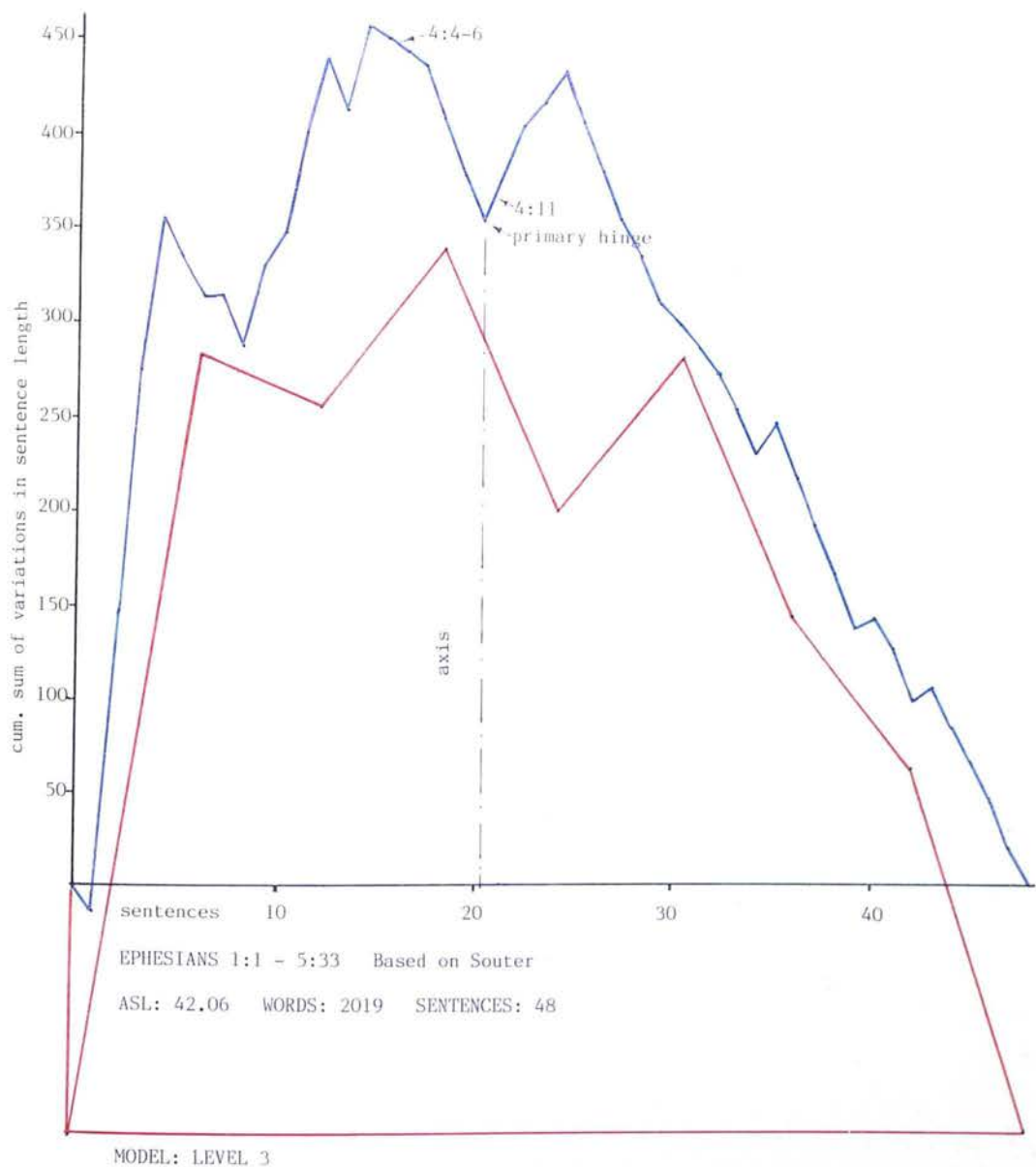
The epistles to Ephesians and Colossians are very similar in construction. Colossians presents fewer problems as it comprises one entire prime pattern, whereas Ephesians has some secondary material attached to the prime pattern (pages 204f.).

Generally, Souter is to be preferred in these letters. UBS yields to the temptation to divide the long sentences, especially in Ephesians, while Souter has a better appreciation of the thrust of the opening passages. Only at one point is UBS to be preferred, and that is at Ephesians 2:8 where the thrust of the verse, "For by grace you have been saved through faith", demands a new sentence. There is also one short sentence at 5:28b which forms a loose couplet with the previous verse; these have been taken as one sentence which is more in scale with the context. With these two minor adjustments, Souter's text is followed in the graphs of Ephesians and Colossians shown on pages 249f. As the contrast in these epistles is very high, the version of the model has been based on an A/B ratio of 2:1 instead of the 1.5:1 used in other epistles. This does not affect the essential topographical features. Ephesians lies close to Level 3 of the Model: Colossians develops rather more detail in its rhythmic structure and shows the characteristics of Level 4.

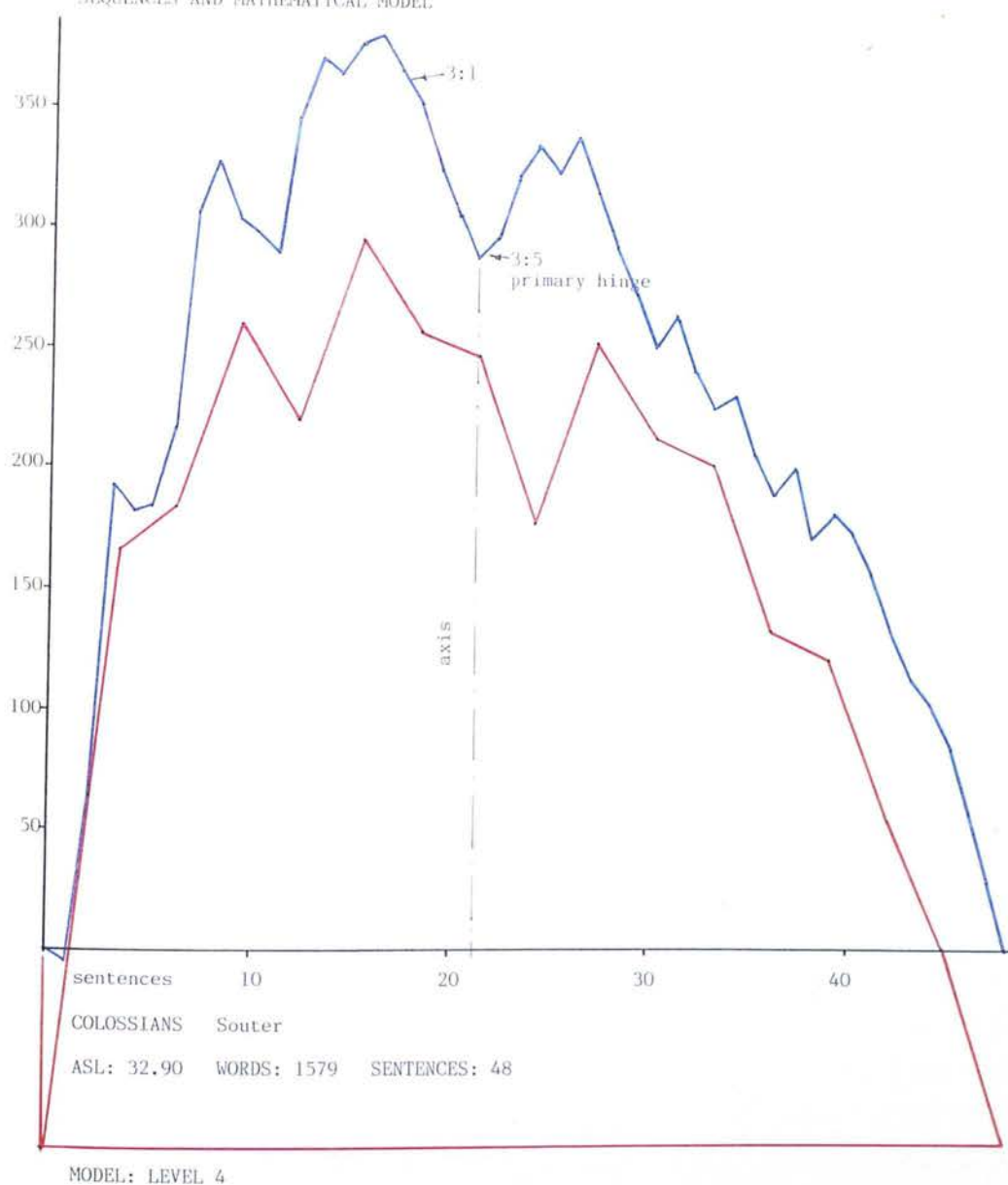
In section 5.2.4 (page 204) it was shown that the prime pattern in Ephesians ends at 5:33 and that the remainder of the epistle is afterthought material. The primary hinge is signalled by the change from the theological to the ethical, 4:4-6 providing the theological high note - "One Lord, one Faith, one Baptism...." - followed by the transition to the ethical - "But grace was given to each of us according to the measure of Christ's gift." Verses 8-10 may be a spontaneous addition during dictation. The primary hinge and the thrust into the B section occur at 4:11 - "And his gifts were that some should be apostles, some evangelists, some pastors and teachers....".

The graph of Colossians (page 250) shows the primary hinge and the thrust into the B section clearly. Chapter 3:1 begins "If then you have been raised with Christ...". This forms something of a marker and is located on the peak to the left of the central notch, in exactly the same position as the marker in Ephesians. The main thrust is from 3:5-13 which corresponds to the right hand half of the notch.

COMPARISON OF GRAPHS OF SENTENCE  
SEQUENCES AND MATHEMATICAL MODEL



COMPARISON OF GRAPHS OF SENTENCE  
SEQUENCES AND MATHEMATICAL MODEL



The sections giving advice to wives, husbands, children etc. are shown on the graphs on page 252, and it is observed that sections which correspond in the text are located in different positions on the graphs. In Ephesians, the advice to wives and husbands falls within the prime pattern; advice to children, further advice to fathers, advice to slaves and masters falls into the afterthought pattern. In Colossians, all such advice falls clearly within the primary pattern. This might be explained as follows. It would appear that in writing to the Ephesians, the author's primary material, which he thought through before commencing dictation, ended at the close of Chapter 5 with the great vision of Christ and the Church. Then, as he continued in a more spontaneous way, the advice already given to husbands and wives suggested advice to children. This required a further mention of fathers, and he then went on to conclude with advice to slaves and masters. Another break occurs at this point and the marker of a new subject appears in τοῦ λοιποῦ, introducing the passage on the Armour of God.

The fact that the advice in Colossians all falls within the prime pattern, suggests that Ephesians is the earlier letter and that the vision of Christ and the Church marks the end of the primary material. In Colossians, the material is entirely recast, so that while the structure is very similar, the content, which the two epistles have in common, is located in quite different places. At an earlier stage, I considered that Ephesians might be a development of Colossians on a larger scale (page 181), but I would now think it more likely that Colossians is later, and has been dictated in one operation, employing some of the material which had previously been used in writing Ephesians.

At this point it may be said that it is extremely difficult to write a work which will reproduce the cumulative sum graph of another work, unless both works are by the same author. The sentence sequences over the whole span of a work are not related to any specific feature which can be recognised as "style" and imitated by someone else. These patterns are produced subconsciously, and it is very difficult to imitate them, even after studying graphs for many years. It is possible to write a work in which the first half consists of rather long sentences, and the second half consists of rather short sentences. That might give a passable imitation of a short letter like Philemon. But the length of each sentence interacts with every other sentence in determining the ASL and the shape of the graph, and attempts

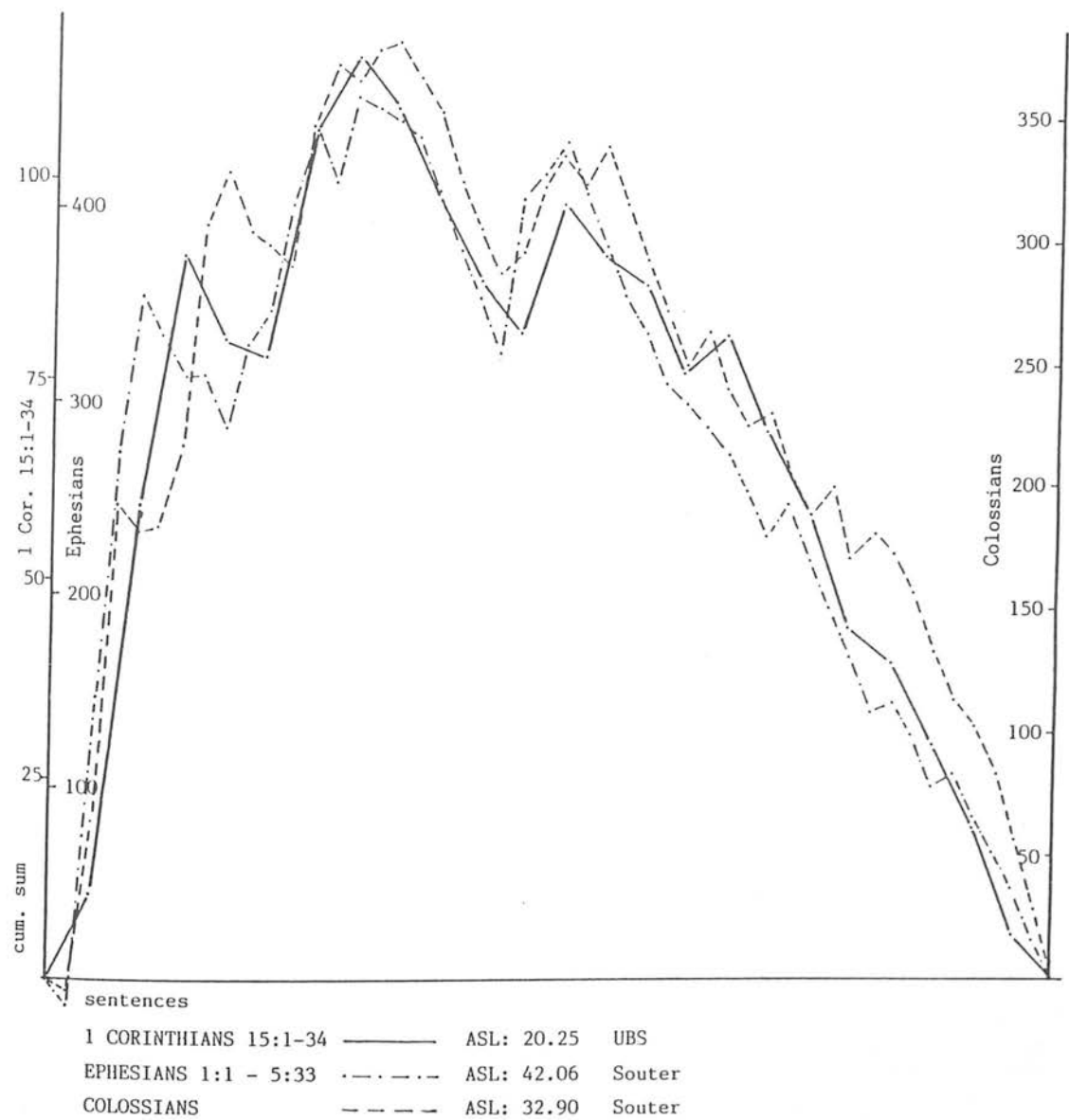


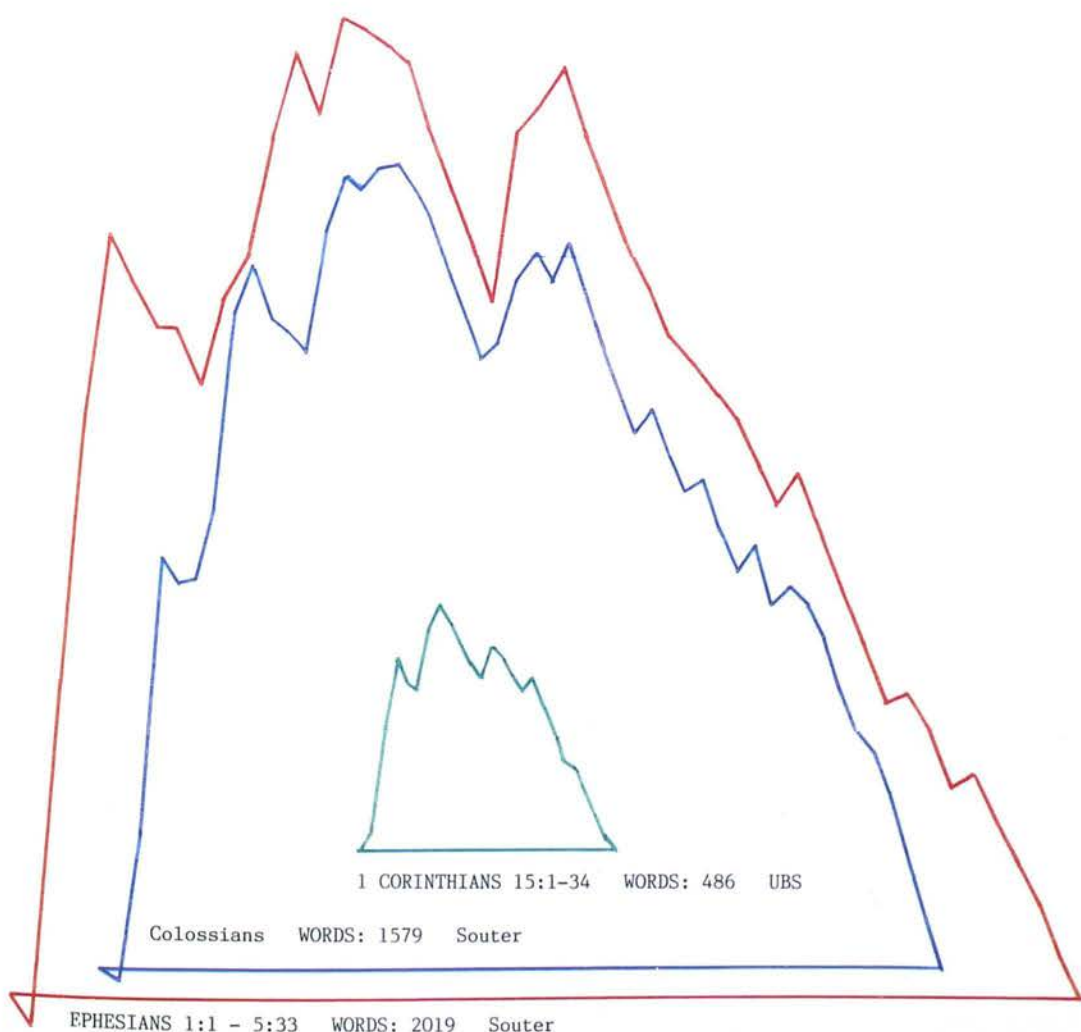
to imitate the interwoven structure of the Pauline epistles (from Level 3 of the Model upwards) have shown how impossible it is. I find it inconceivable that two different authors could produce the patterns which are found in Ephesians and Colossians, even if the second author attempted to imitate the style of the first and borrowed ideas and vocabulary, and tried to imitate the syntactical construction of the first author's work.

On page 254 the sequence graphs of Ephesians and Colossians are compared with the graph of the short passage on resurrection in 1 Corinthians 15:1-34. The difference in scale is great, as the ASL of the Corinthian passage is about half of that of Ephesians. The three graphs are superimposed on a standard base in order to show the similarity of shape. The differences in size are considerable; this is shown on page 255 where the lengths of the bases are proportional to the lengths of the texts.



GRAPHS OF SENTENCE SEQUENCES



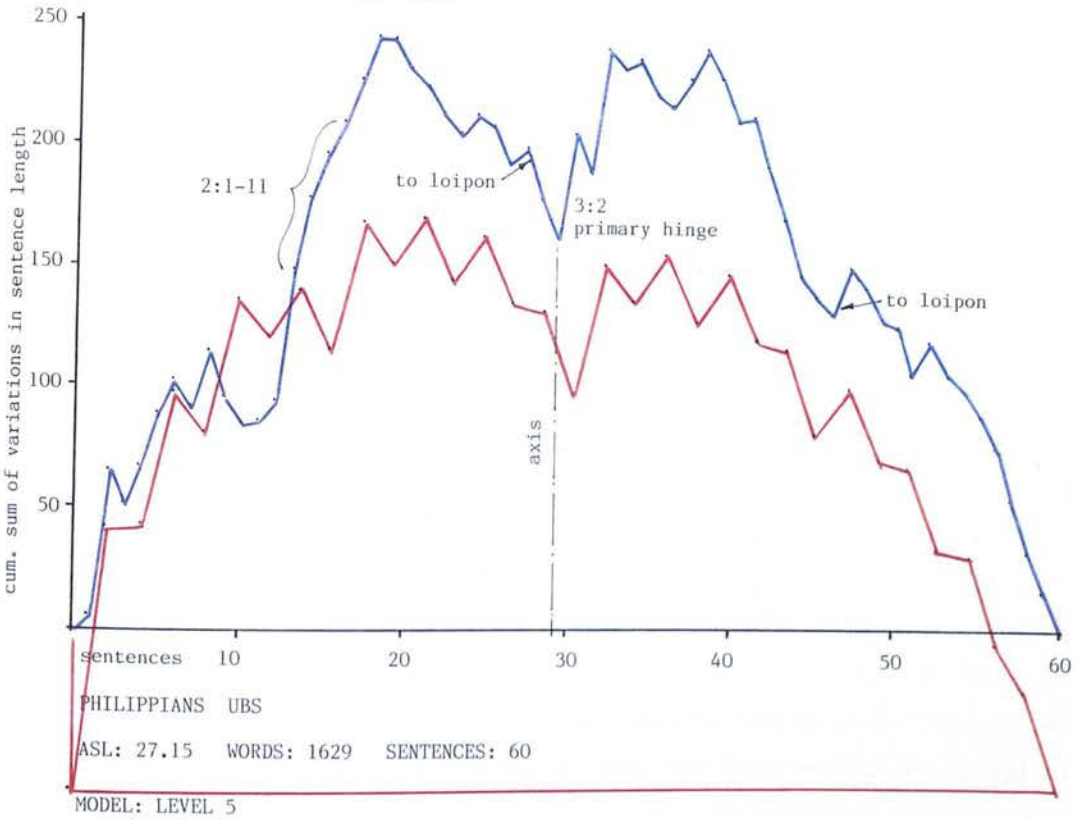


COMPARISON OF SHAPES AND SIZES OF PAULINE EPISTLES

### 5.4.6 Philippians

The whole epistle provides a primary pattern. The graph shown on page 257 is based on UBS. The primary hinge is clear, and the two τὸ λοιπὸν markers are shown in their respective notches. The scale relationship between these markers was previously shown on page 197. UBS have given grammatical consideration to the sentences following the first marker and failed to convey the thrust into the B section. Souter, who is followed here, takes 3:2-6 as one sentence. Two short sentences in chapter 1 are linked with adjacent sentences at 1:3-8 and 1:21-22. There is an imbalance in the first portion of the epistle up to 2:18. This is due to the surge from 1:27 to 2:18 which contains hymnic material. Rather than look for insertions, I would prefer to think that Paul got carried away with this strong line of thought, with the result that this section of the graph is somewhat exaggerated.

COMPARISON OF GRAPHS OF SENTENCE  
SEQUENCES AND MATHEMATICAL MODEL

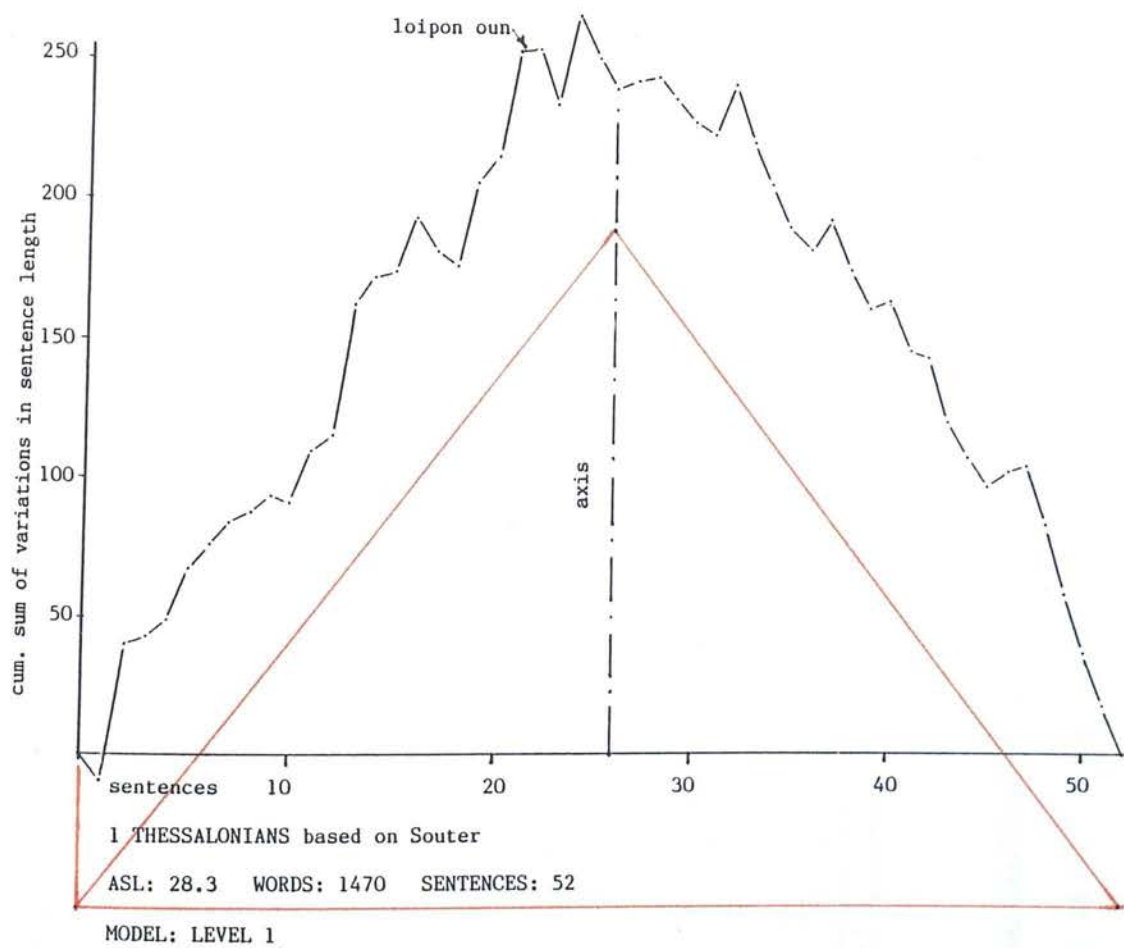


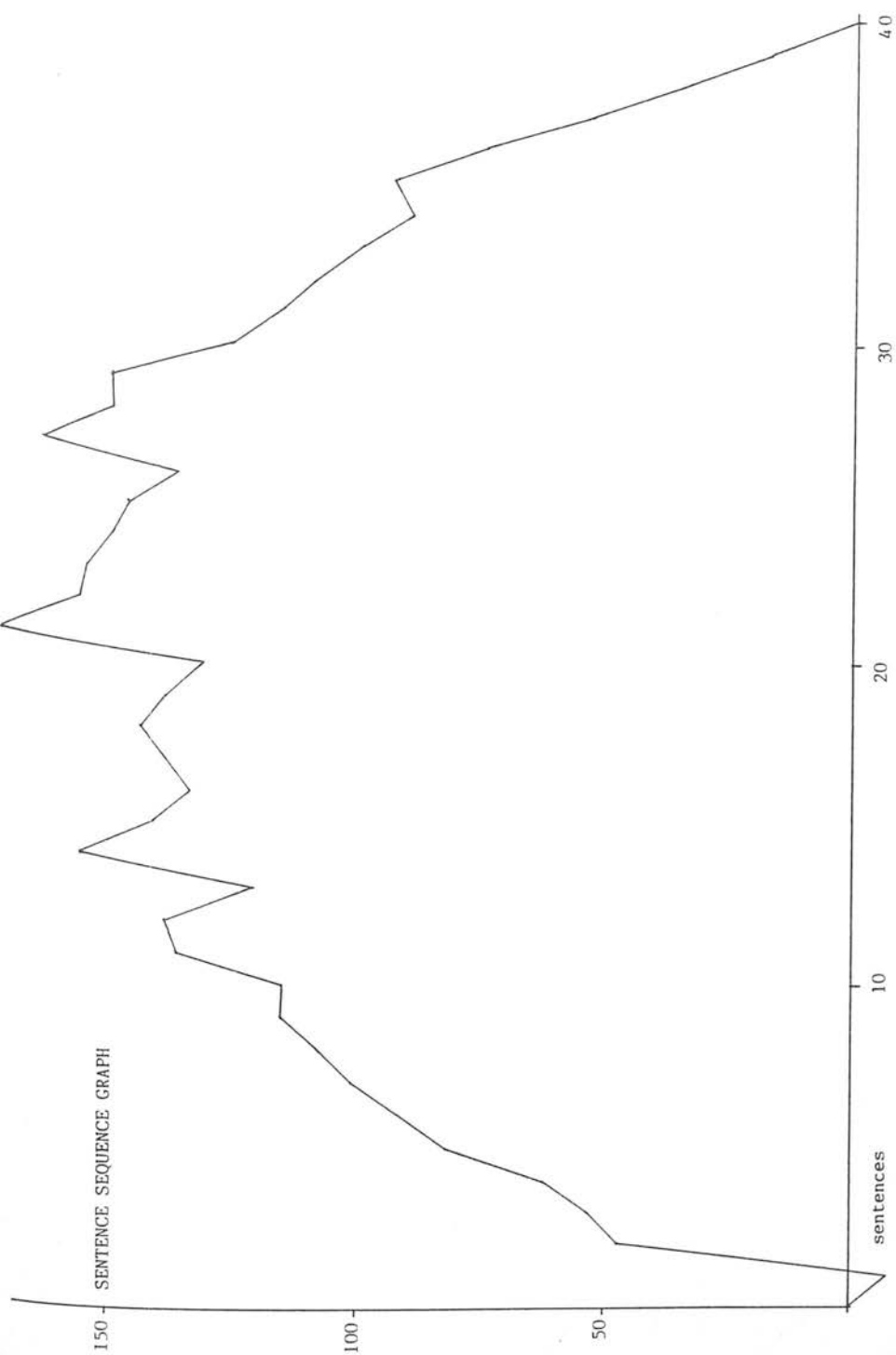
#### 5.4.7 1 and 2 Thessalonians

Each of these epistles comprises a primary pattern. Both contain λοιπόν markers in the mid position.

In the case of 1 Thessalonians, differences between UBS and Souter are caused mainly by the punctuation of 2:14 - 3:4. Souter is to be preferred, with the questions and following statement at 2:19-20 being grouped. The subject matter in 1 Thessalonians does not provide the kind of material which would give the thrust normally found at the beginning of the A and B sections in Paul's letters. There is the usual contrast in ASL between the A and the B sections, but the text is very even and lacks local contrast. It appears to be of simple construction, developed from the basic contrast represented by Level 1 of the Model. The graph is shown on page 259. The division into two letters according to Schmithals' theory, which is quoted by Kümmel [36, p. 261], does not produce convincing forms. The graph of 1:1-2:12 = 4:2-5:28 which in Schmithals' view would form a complete letter is shown on page 260. As he has combined the opening and closing sections of a prime pattern and omitted the central section, the overall contrast is maintained, but the shape is problematical. The remaining section, 2:13-4:1 provides the sequence graph on page 261, which, even allowing for missing opening and closing sections, is a most unlikely form.

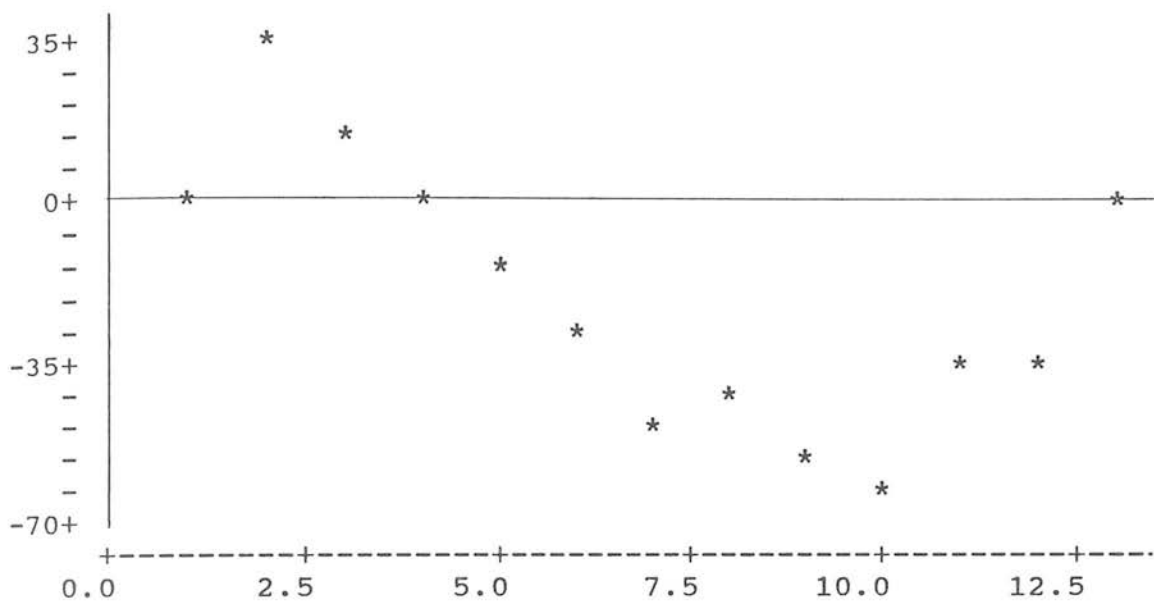
2 Thessalonians is written in a different mood and has much more attack. The structure is dominated by the extraordinary second sentence which UBS and Souter agree is 158 words long - almost a fifth of the entire letter. The graph using UBS is shown on page 263. The opening sentence sequence suggests that a much longer letter is to follow. This, however, is misleading, for it is the nature of the subject matter (the judgement at Christ's coming) which accounts for the scale of the opening. The placing of the τὸ λοιπόν marker is consistent with the other epistles in which such a marker is found. Schmithals' division into two letters [36, p.265] is not convincing, and in his scheme the τὸ λοιπόν would be displaced, serving only the purpose of introducing two verses of final greetings, instead of marking the break between the large scale and the small scale sections. It must be recognised that the very long sentence is a rogue sentence, even though the cause is apparent. It might be compared with the long sentences found in





1 THESSALONIANS 1:1-2:12 and 4:2-5:28 (Schmithals' theory.)

ASL: 26.37 Words: 1055 Sentences: 40



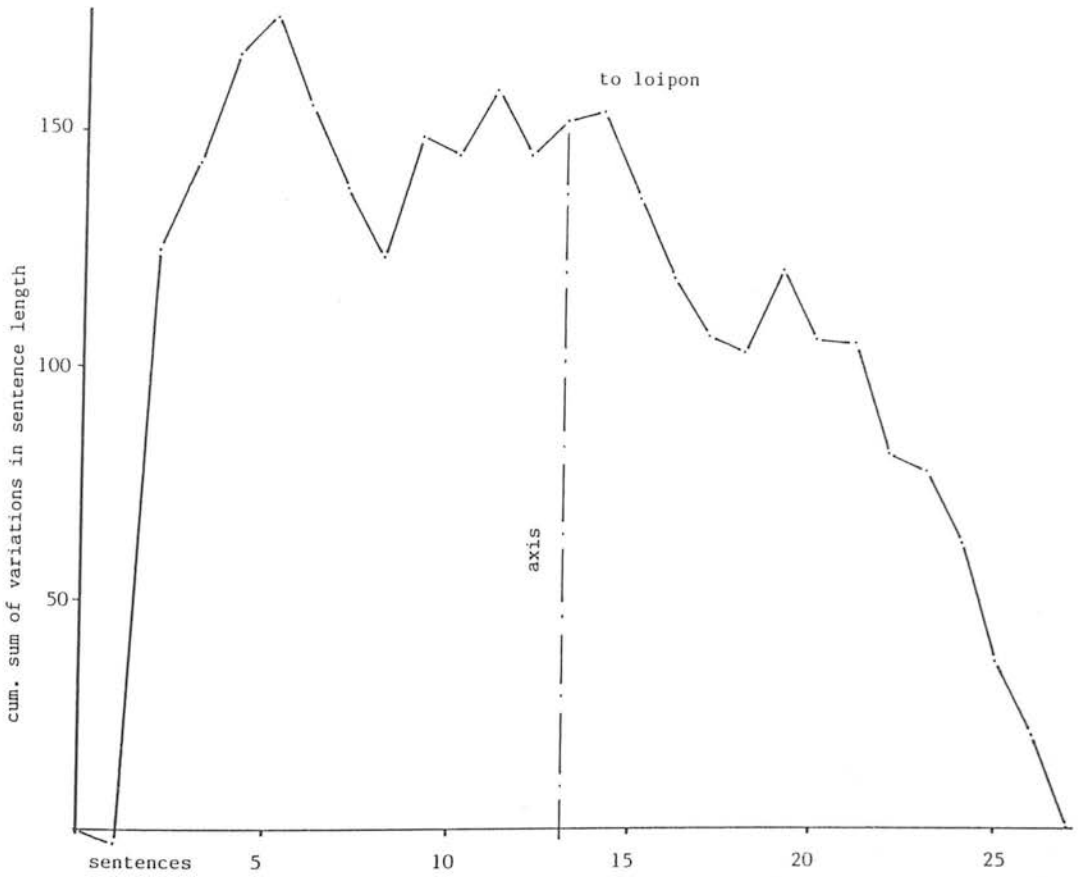
1 THESSALONIANS 2:13-4:1 (Schmithals' theory)

ASL: 32.77 WORDS: 426 SENTENCES: 13



James S. Stewart's sermons with high numinous content (page 69). To mitigate the effect of this rogue sentence, it might be divided at two points marked by colons in Souter's version. This is not to be justified on syntactical grounds, but is a device to show the extent of the distortion caused by this rogue sentence. That adjustment recovers much of the skewed symmetry, with the axis placed near the τὸ λοιπὸν marker. The adjusted graph is compared with a logarithmic form of the Model on page 264. The enormous contrast in scale within such small compass, which is caused by the extraordinarily long second sentence which accounts for about one fifth of the entire letter, makes the analysis of this letter the most problematical in the Pauline corpus.

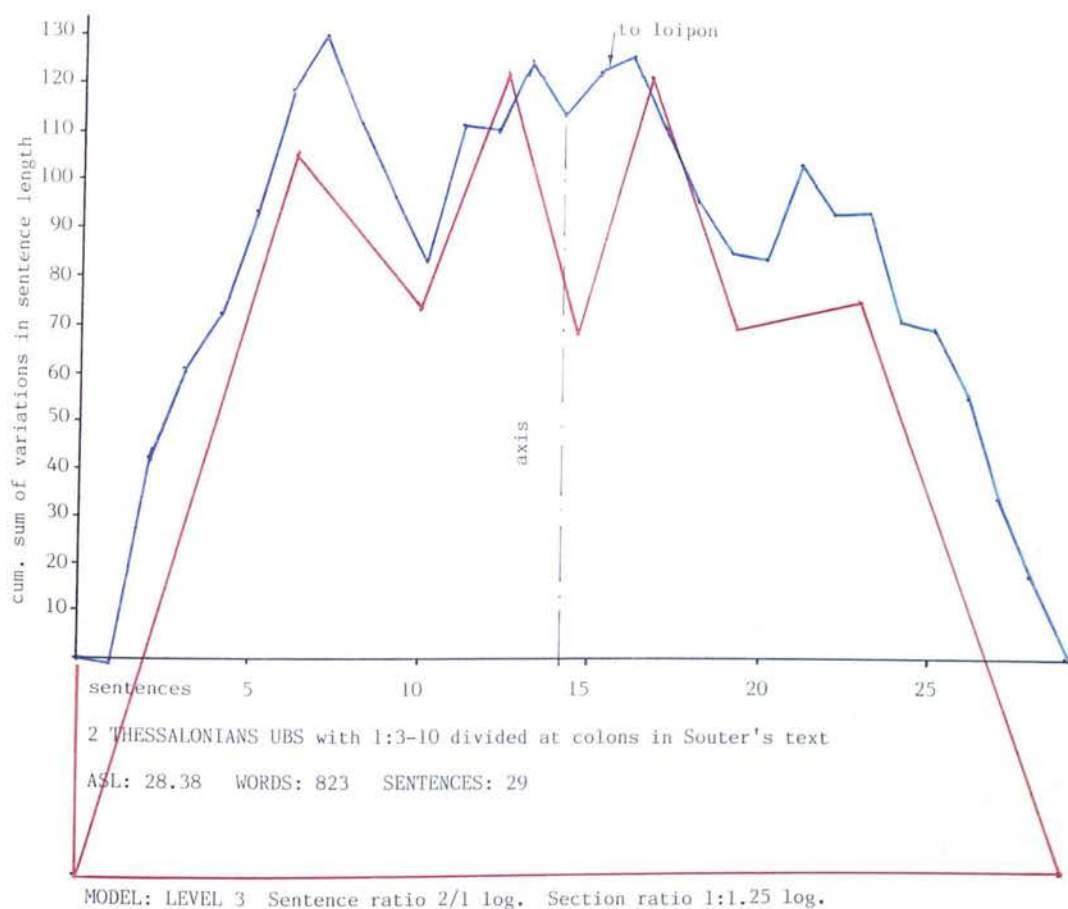
GRAPH OF SENTENCE SEQUENCES



2 THESSALONIANS UBS

ASL: 30.48 WORDS: 823 SENTENCES: 27

COMPARISON OF GRAPHS OF SENTENCE  
SEQUENCES AND MATHEMATICAL MODEL



#### 5.4.8 1 and 2 Timothy

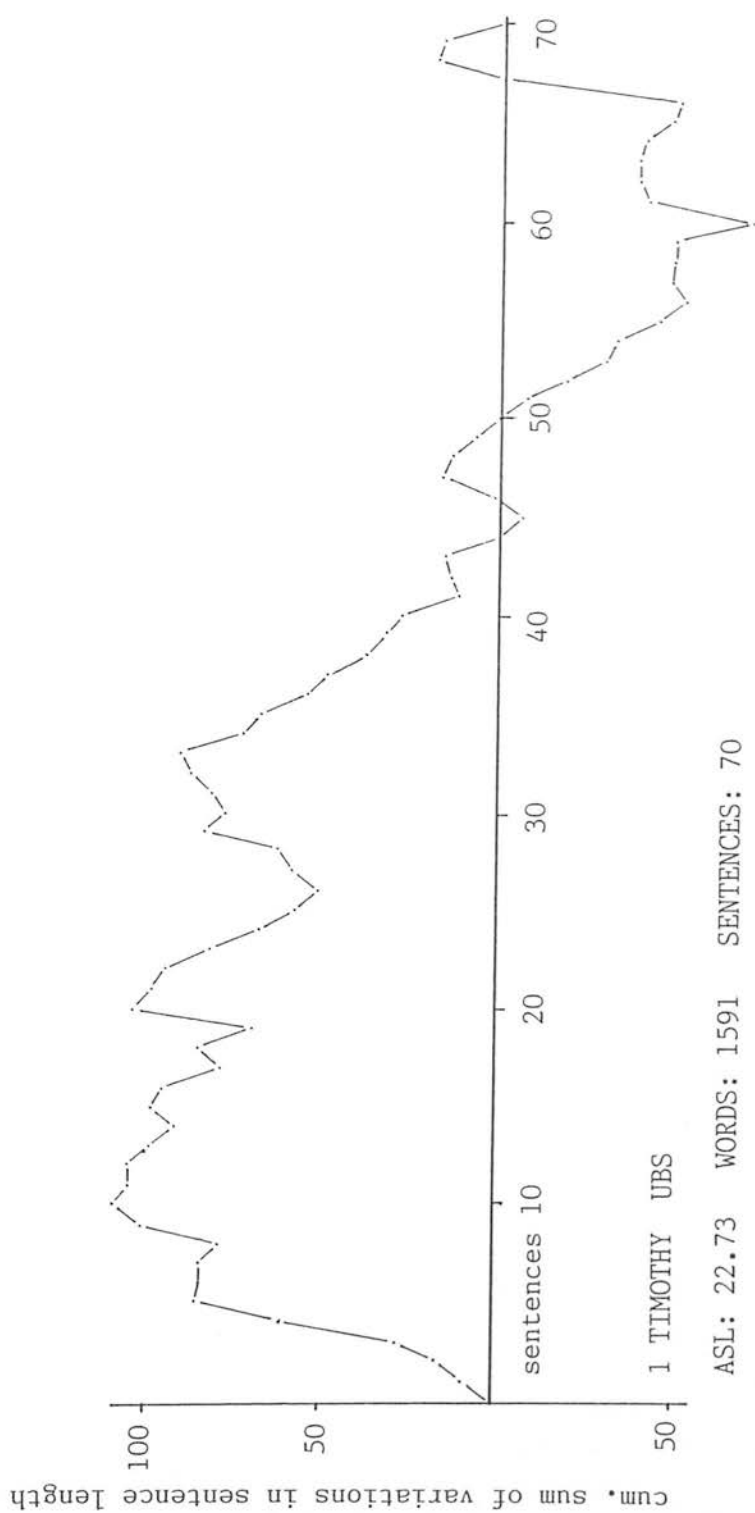
The cumulative sum graph of 1 Timothy (page 266) shows that the letter begins with a prime pattern, to which sundry material has been added as afterthoughts. The prime pattern is not altogether satisfactory, and the disruption in the centre of it is easily traced to 3:1-13 which lists the qualities required in church leaders. To this I would add vs. 14-16 which are out of place, and which may be linked to the foregoing advice. The secondary thrust following the hinge point begins at 4:1, and a balanced pattern would go on to about 5:7 after which it merges into more spontaneous material. It is possible that Paul thought through his material up to the end of Chapter 4 with the idea of going on thereafter to give advice to various groups of people as he did in Ephesians and Colossians. Having covered the ground which he had thought through, he went on to give advice in a more spontaneous way. The graph of the secondary material from 5:8-6:21 is shown on page 267.

The advice concerning church leaders and the following verses included in 3:1-16 are more likely to be a later insertion by another hand, than a spontaneous addition during dictation. This possibility is considered later (page 272). When that short passage is removed, 1:1-5:7 gives a typical Pauline prime pattern, with the hinge point in the correct place, and with the quality of skewed symmetry found in other epistles. Souter's version thus altered, and with 2:13 divided as UBS, is shown on page 268.

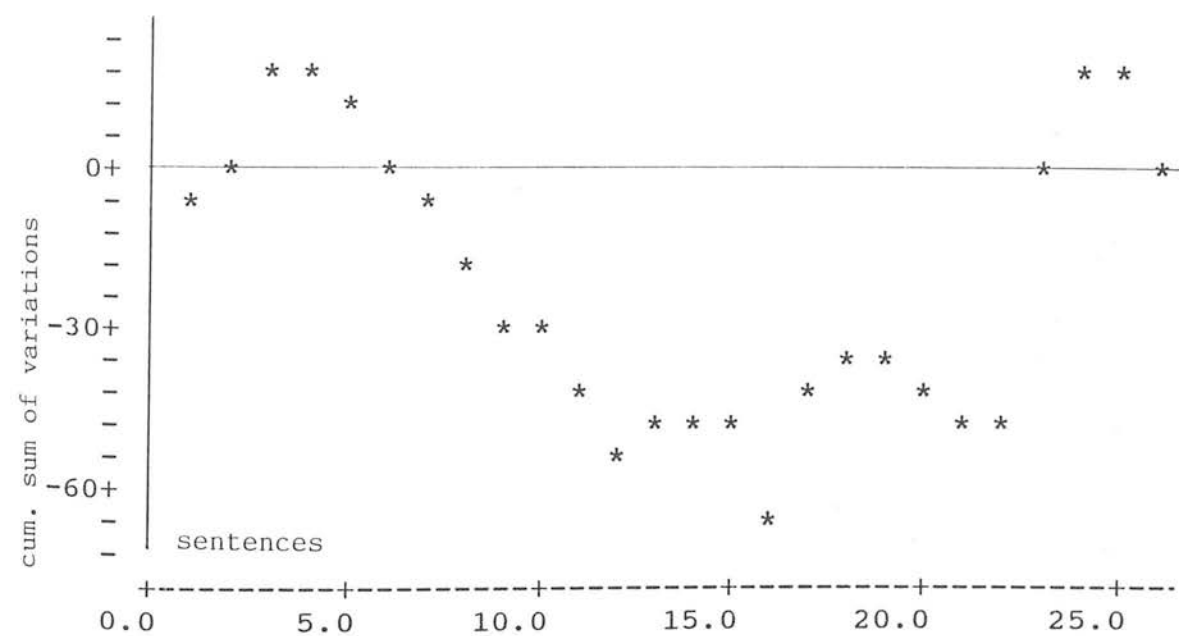
The graph of 2 Timothy (page 269) is Pauline in character but not in overall shape. Several possibilities were considered:

1. It may be a combination of two patterns of primary material. The first part, from 1:1 to 2:7 (or 2:19) might possibly be a brief note if closing greetings were added. The text from 2:8 (or 2:20), even with missing opening greetings added, do not make a good beginning for a second letter, though the resulting graph would have Pauline features.
2. A pastoral letter of this kind is of a different genre from Paul's carefully prepared theological letters. This may be an informal, spontaneous, rather rambling letter, written when the author was feeling the effects of his sufferings.

SENTENCE SEQUENCE GRAPH



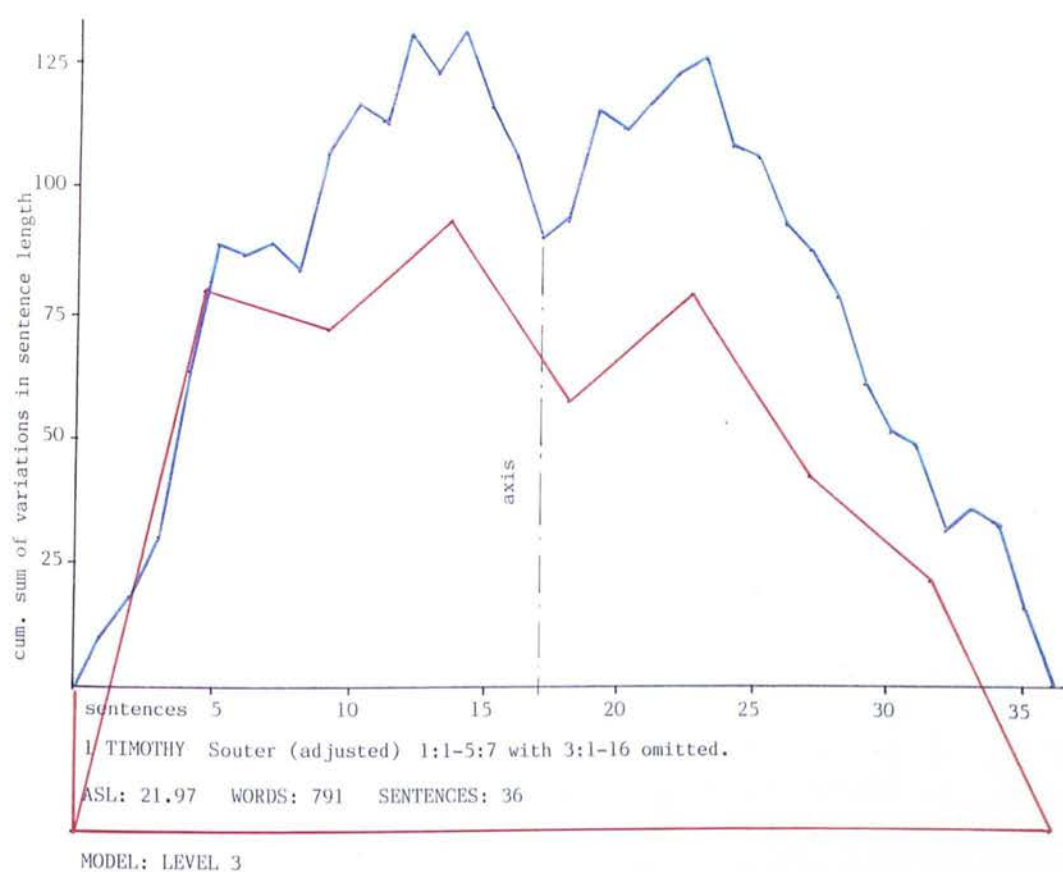
# SENTENCE SEQUENCE GRAPH



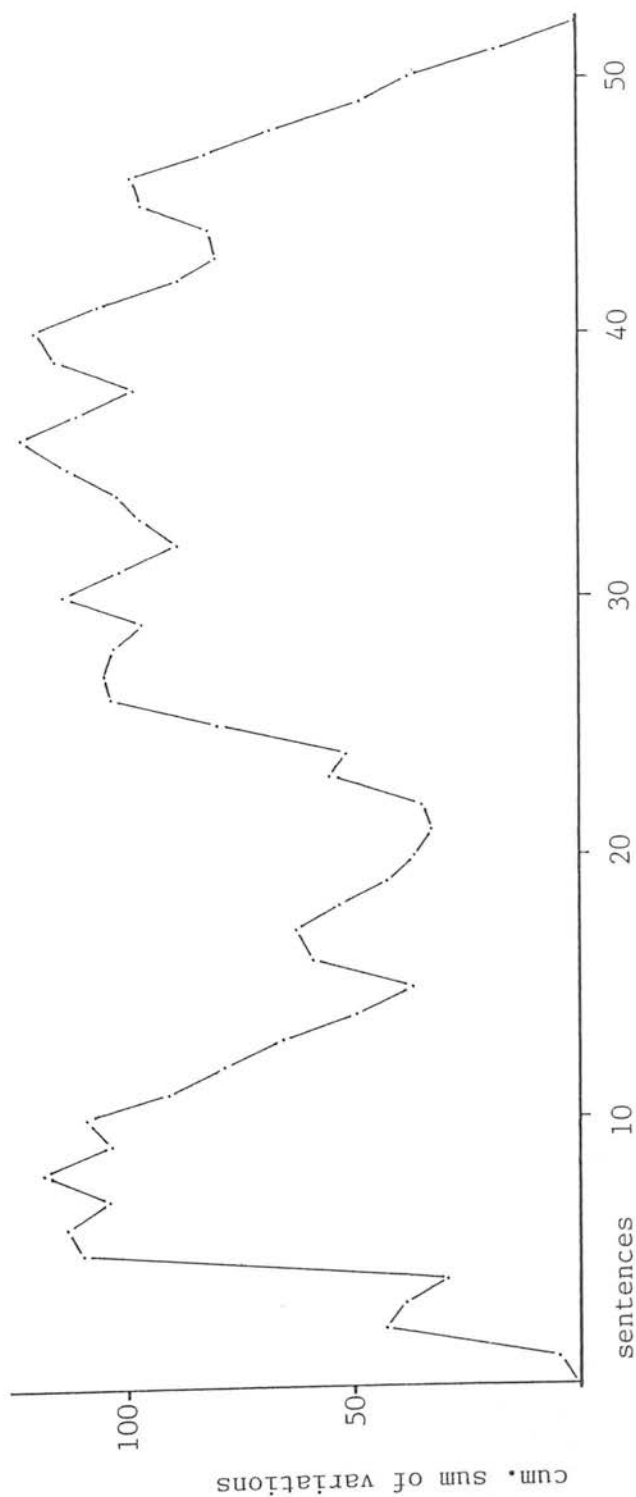
1 TIMOTHY 5:8 - 6:21 UBS

ASL: 22.73 WORDS: 591 SENTENCES: 26

COMPARISON OF GRAPHS OF SENTENCE  
SEQUENCES AND MATHEMATICAL MODEL



# SENTENCE SEQUENCE GRAPH



2 TIMOTHY UBS

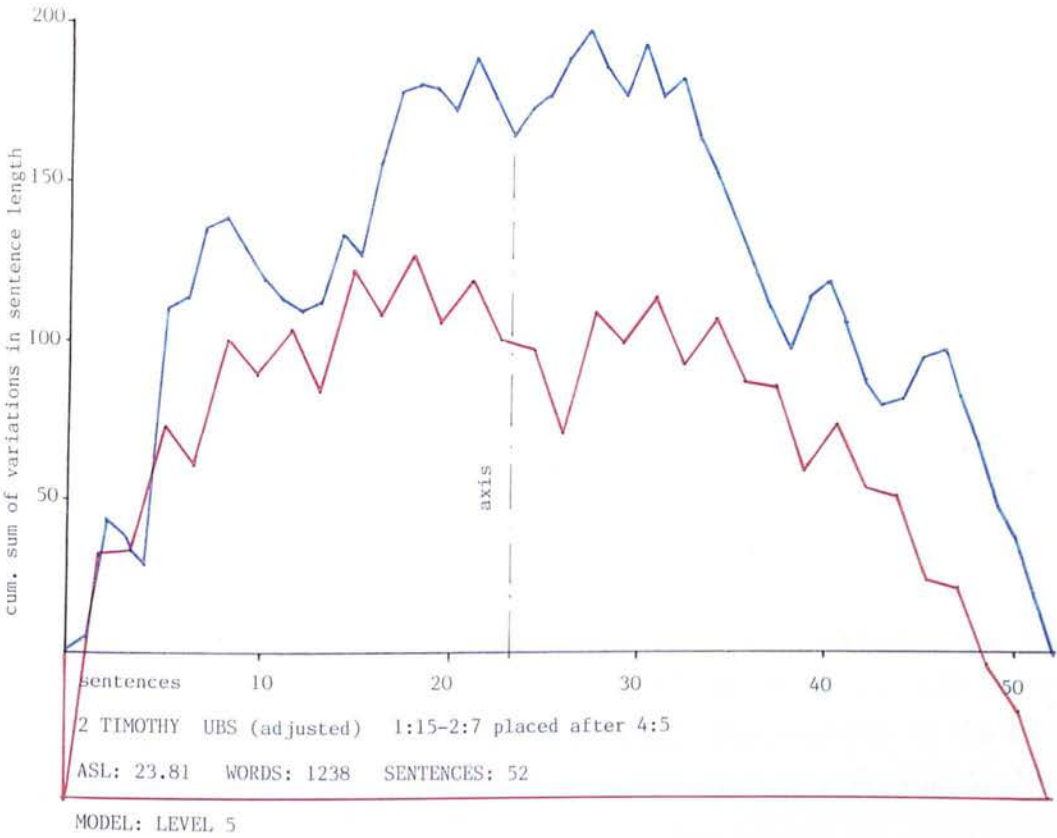
ASL: 23.81 WORDS: 1238 SENTENCES: 52



3. It may be conflated material, assembled by another hand. It is difficult to distinguish between badly conflated material and a rambling kind of letter which tends to mix up subject matter. Conflation tends to destroy patterns, even when small amounts of material are involved.

4. There may be a displacement of material, through pages being mixed up either in Paul's time, or later during copying. It is noted that 1:15-18 is the kind of material which would sit more comfortably towards the close of the letter. From 2:1 to 2:7 might also be closing advice to Timothy. A case could be made for inserting such a block after 4:5 or 4:15. One cannot be sure what size of sheet was used at the various stages of transmission of the text, but the suggested block accounts for about one sixth of the letter, and fitting it in after 4:5 places it roughly one sixth from the end of the letter, indicating the misplacement of one page. Several possibilities were considered using both UBS and Souter. The most convincing is the simplest - that of transferring 1:15-2:7 to a point after 4:5. This gives a reasonably continuous text (in a rambling letter) and has a dramatic effect on the graph (page 271), which becomes similar to the adjusted graph of 1 Timothy, and also to that of Philippians, with the hinge point located in the correct position. The opening stepped pattern assumes its proper relationship to the whole graph. All the possible solutions pointed to the B section beginning at 3:14, which is a suitable text for the thrust beginning, "But as for you..." The adjustment suggested is a small one, but it solves problems regarding both the continuity of the text and the sequence pattern, and I tend to favour this solution.

COMPARISON OF GRAPHS OF SENTENCE  
SEQUENCES AND MATHEMATICAL MODEL.



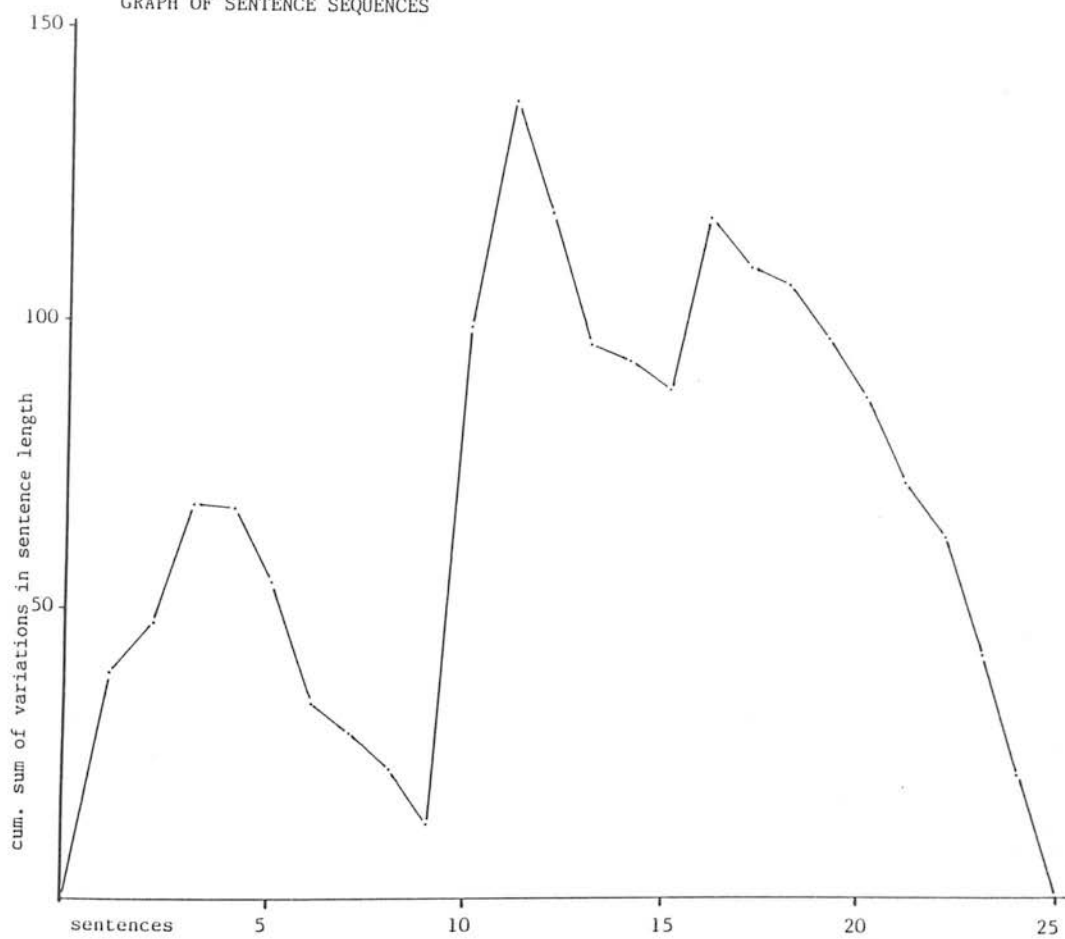
#### 5.4.9 Titus

The problems presented by Titus are similar to those found in 2 Timothy, as the graph using Souter's version on page 273 shows. Again a passage giving advice regarding the qualities required in church leaders is found in 1:7-9. As in 1 Timothy, this should be removed. A further passage concerning the character of Cretans (1:12-16) is suspect. Souter's punctuation is to be preferred generally, but 2:1-10 may be divided at the colon (full stop in UBS) into 54+59 words, and the little question in 2:15 (3 words) linked with the rest of the verse. With the removal of the two suspect passages and with these minor changes, the resulting graph is shown on page 274 and compared with Level 2 of the Model. The new section begins at 3:1 and the main thrust of the B section is at 3:4. Skewed symmetry is recovered.

Graphical considerations suggest that both passages in Titus and 1 Timothy concerning the qualities of church leaders are afterthoughts or insertions. While it may have been possible for the first to have been a spontaneous addition during dictation, it is unlikely that Paul would do this a second time. It is therefore more likely that these are insertions made by another hand at a later date. Goodspeed's [27a]<sup>p (2)</sup><sub>h</sub> speculation that Bishop Onesimus of Ephesus made an early collection of Pauline letters, including Philemon which may have referred to himself in his younger days, is attractive. It would be natural for such a bishop to add marginal notes concerning the qualities of leaders for circulation to his congregations, and for these to be incorporated in the text in subsequent copying. It is a romantic suggestion, but plausible.

Kenny [35, p. 100] concludes that twelve of the Pauline Epistles are the work of a single, unusually versatile author. The epistle which he rejects is Titus. As the table on page 99 of his book shows, Titus is further away than any other epistle from each of the epistles taken in turn. The one exception is, significantly, 1 Timothy, which is closer to Titus than it is to several of the other epistles. It is noted that in the majority of cases the figures for Titus regarding the 96 features are equal to, or bracketed by, the figures for other letters. Where the figures for Titus lie at the edge of the range there are special considerations to be noted. For example, in the case of  $\dot{\iota}\nu\alpha$ , ten of the thirteen instances are subject-related, referring to "the

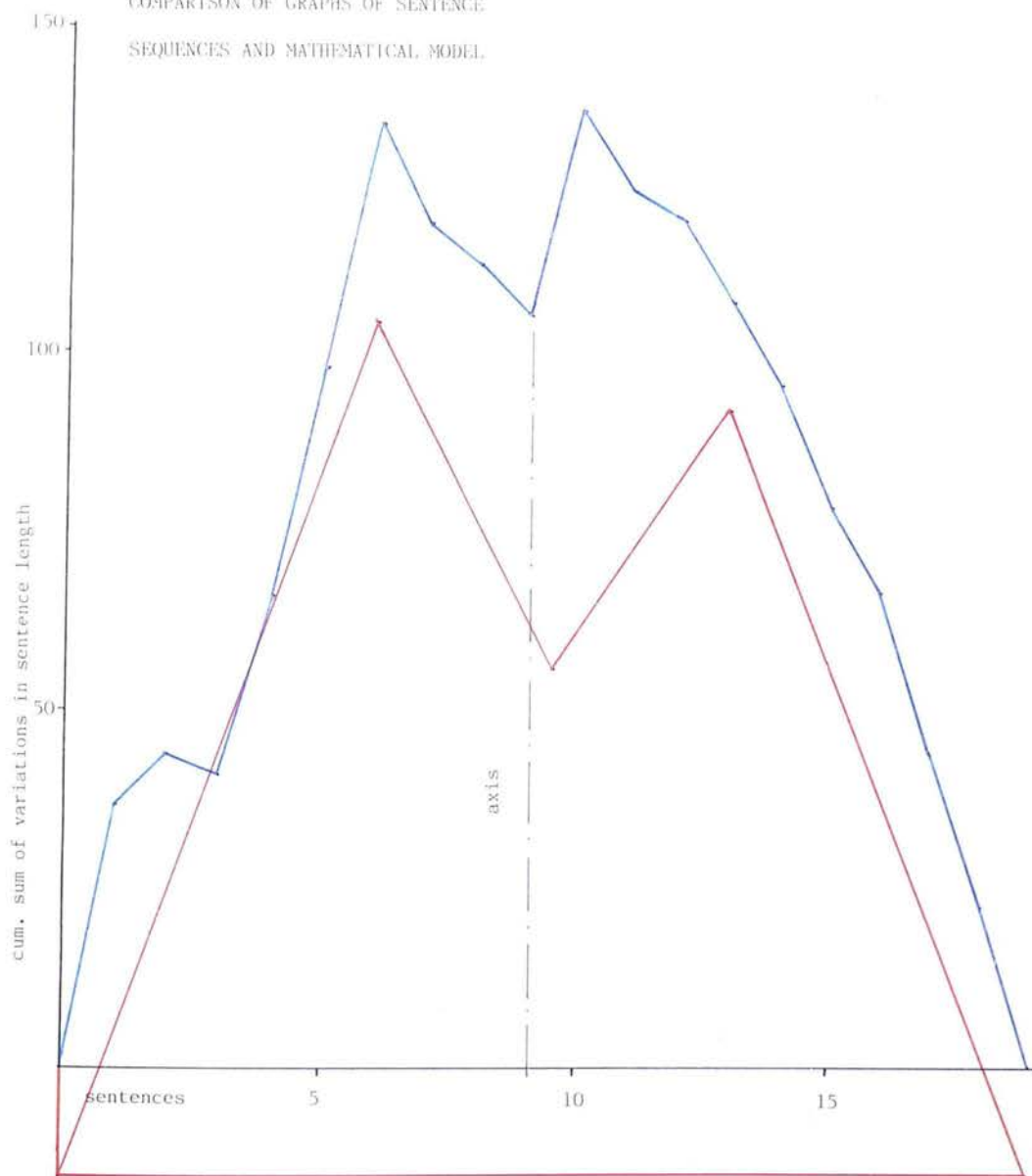
GRAPH OF SENTENCE SEQUENCES



TITUS Souter

ASL: 26.28 WORDS: 657 SENTENCES: 25

COMPARISON OF GRAPHS OF SENTENCE  
SEQUENCES AND MATHEMATICAL MODEL.



MODEL: LEVEL 2

TITUS Souter (adjusted) 1:7-9. 12-16 omitted.

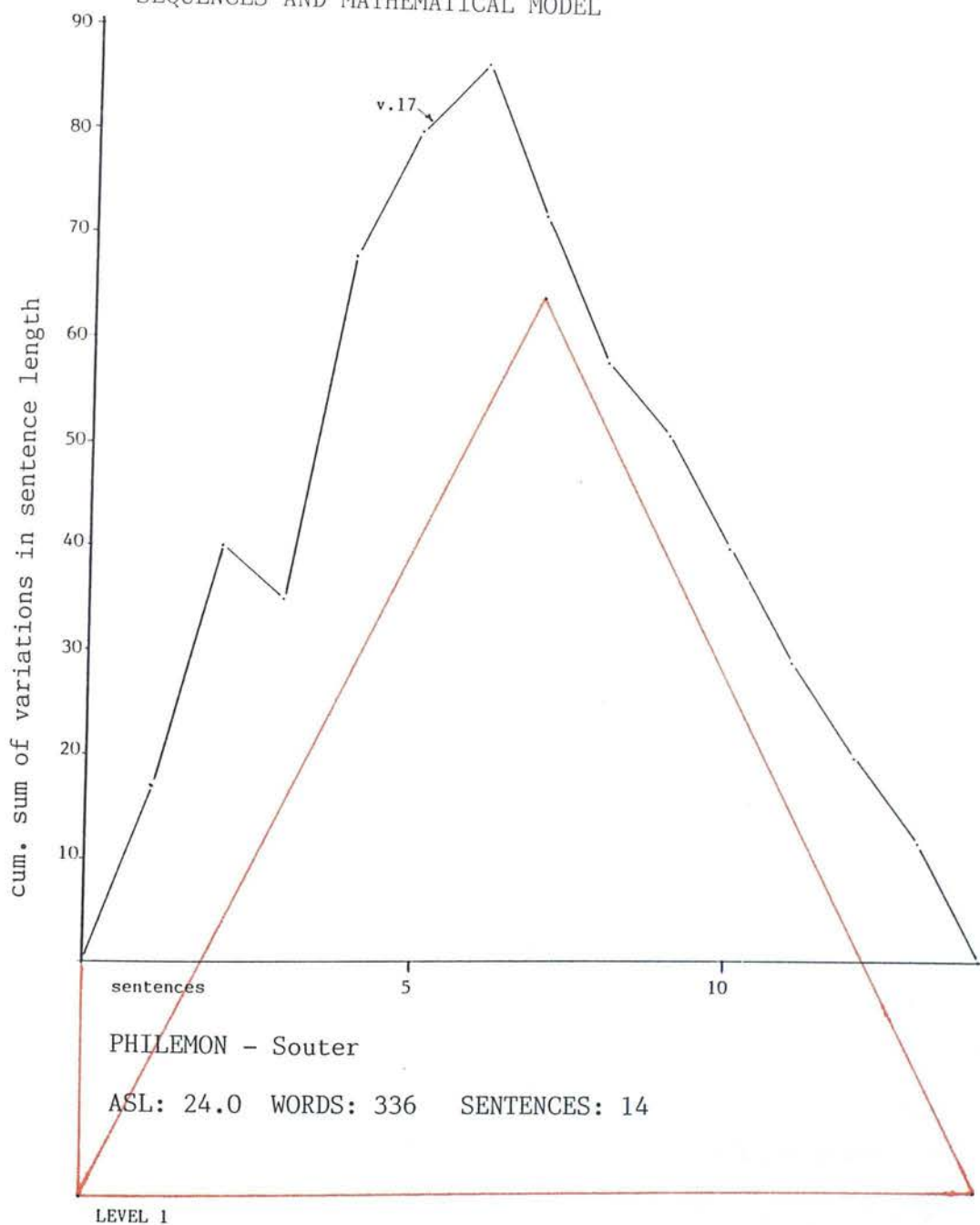
ASL: 28.05 WORDS: 533 SENTENCES: 19

purpose of instruction". In the cases of Dative Articles, Feminine Articles, Distribution of Nouns in the Nominative Case, many of these occurrences are found in the two passages noted above as being suspect. Similarly the high figures for Adjectives, and Adjectives in the Accusative Case, reflect a predominance of descriptive adjectives found in lists of qualities concerning bishops, Cretans, Christians and conduct. When allowance is made for occurrences being specifically subject-related, and when the suspect passages are removed, any distinction between Titus and the other epistles is considerably reduced. This is worthy of further investigation by a statistician.

#### 5.4.10 Philemon

There is little difference between UBS and Souter in Philemon. The graph, using Souter's punctuation, is shown on page 277 and corresponds to Level 1 of the Model. It may be noted that at this level there is no notch in the graph and the hinge point between sections A and B occurs at the peak of the graph. There is a straight contrast between a series of over-average and a series of under-average sentences. The thrust comes at v.17 (leading to the peak on the graph) where Paul challenges Philemon - "So if you consider me your partner, receive him as you would receive me."

# COMPARISON OF GRAPHS OF SENTENCE SEQUENCES AND MATHEMATICAL MODEL





## 5.5 The Classification of the Pauline Texts

The type of pattern which has been termed a "prime pattern" was first identified in my own work, where a recognisable pattern could be related to a quantity of material which had been thought through and written out in one operation. Some of my pieces consisted of several such patterns linked together, showing scale differences between the sections. Romans and Galatians provided graphs with similar features, though on different scales, and it appeared likely that parts of these letters had a similar origin. The second group including Philippians, Colossians, 1 and 2 Thessalonians and Philemon, provided graphs of quite different proportions, but with some similar features. This second group was taken as test material, without altering the UBS punctuation in any way, and the λοιπόν markers appeared in the expected positions with startling regularity. Where these markers were lacking, there were clear changes from the theological to the ethical. This established the fundamental scaling structure of that group without tampering with the text in any way.

It was then possible to identify the area of symmetry in Ephesians and to separate the prime material from the secondary in that epistle. Romans and Galatians have the problem caused by a large number of questions which are out of scale with their context. These questions may be grouped according to syntax and content but this involves subjective judgement. To minimise that, an alternative was devised which grouped questions together with context in a purely mechanical way: this produced substantially the same shape of graph. With that assurance it was then possible to isolate the prime patterns in Romans and Galatians. 1 and 2 Timothy and Titus presented special problems, but the solutions offered are by no means novel. Rather they tend to confirm views that have long been held by some scholars, and the explanations regarding the disruptions in the graphs are uncomplicated.

The most convincing aspect of the process of identifying the prime patterns has been that although the separation was done graphically and without reference to the content of the text, it was then found that the principal features of the prime patterns related, almost invariably, to the content of important texts. Only occasionally did the end of a prime pattern

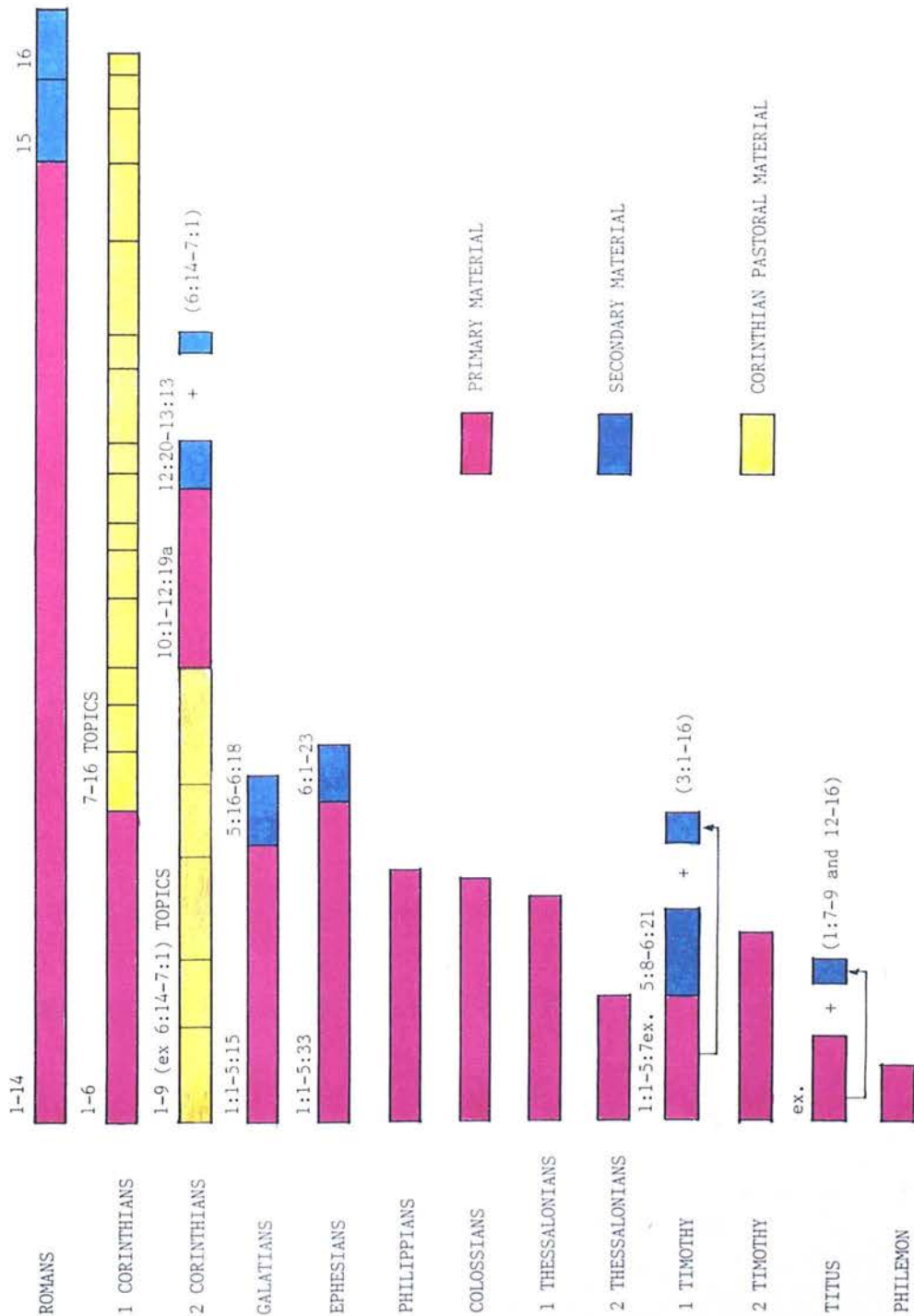
merge into secondary material. It must be emphasised that material classed as secondary may well be the work of Paul. The distinction is simply between prepared material, dictated in one operation, and more spontaneous material added to it. As I indicated earlier, this classification is not sensitive enough to identify small glosses, but it does show a very strong and characteristic scaling structure running through all thirteen epistles.

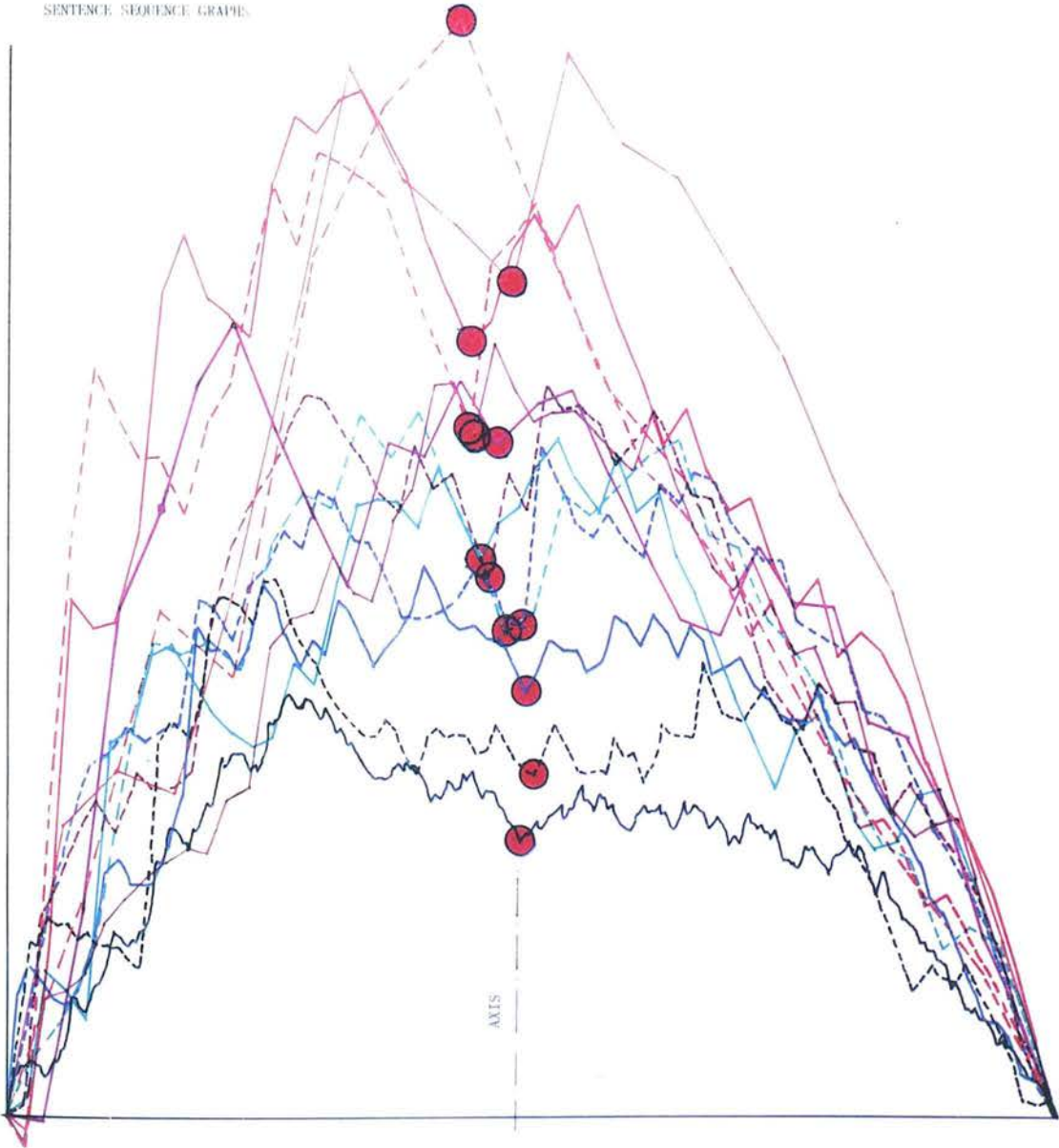
The classification of the Pauline epistles is then presented as shown on page 280. The Corinthian "topical" material has been classified separately, as it provides a series of small patterns related to the topics. Other secondary material is not extensive, being limited to Romans 15 and 16, an afterthought to the letter found in 2 Corinthians 10:1-12:19a, the small fragment of a letter in 2 Corinthians 6:14-7:1, and afterthoughts to Galatians, Ephesians, and 1 Timothy. The material relating to the qualities required in leaders in 1 Timothy 3:1-16 and Titus 1:7-9,12-16 I take to be later insertions, possibly by a bishop in the Early Church. These are the only insertions I can detect.

The rhythmic structure of the scaling patterns is exceptionally strong. It is possible to conceive of a cyclic pattern of long and short sentences, gradually reducing in amplitude as the epistle progresses. That would account for the construction of the simpler letters up to the equivalent of Level 3 of the Model. But at that point it becomes necessary to apply a new thrust, involving an increase in scale mid way through the epistle, in order to accomplish the higher levels. After considering this for some years, I am still at a loss to explain how an author may accomplish this subconsciously, but the pattern of these higher levels in the Pauline epistles is clearly there.

The strength of the rhythmic construction of these letters is reflected in the collage on page 281 which may be compared with the collages of the samples of other authors' works shown on pages 76, 84, 90, 95, 102, 107, 113, 120 and 123. For convenience small black and white reproductions are shown on pages 282ff. There is a difference between the Pauline collage and the others, in that in the cases of the other authors, whole works are shown. In Paul's case only the prime patterns are shown. These account for a high proportion of all Paul's epistles - 67% of the total text, or 88% if the topical patterns of the Corinthian correspondence are discounted. The common features shared by all the Pauline epistles are evident - the central axis

# CLASSIFICATION OF PAULINE TEXTS



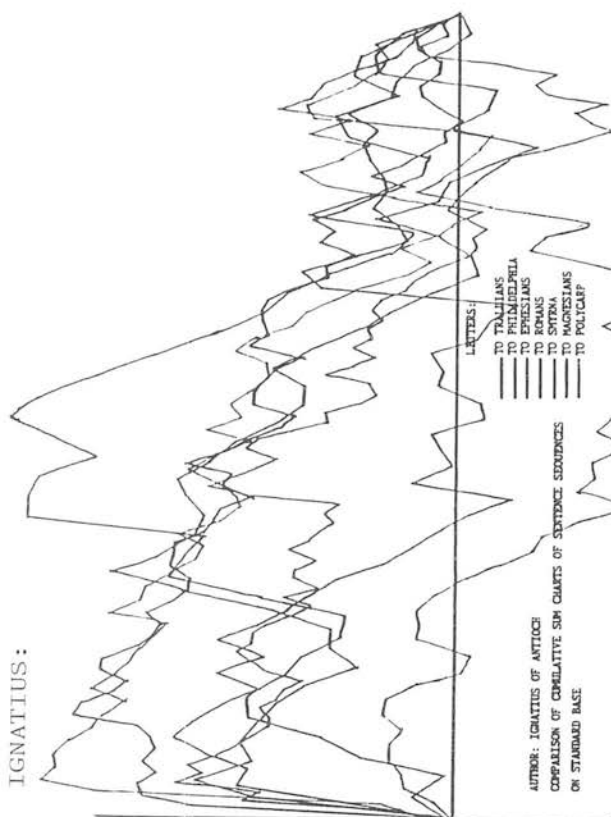


COMPARISON OF PAULINE PRIME PATTERNS

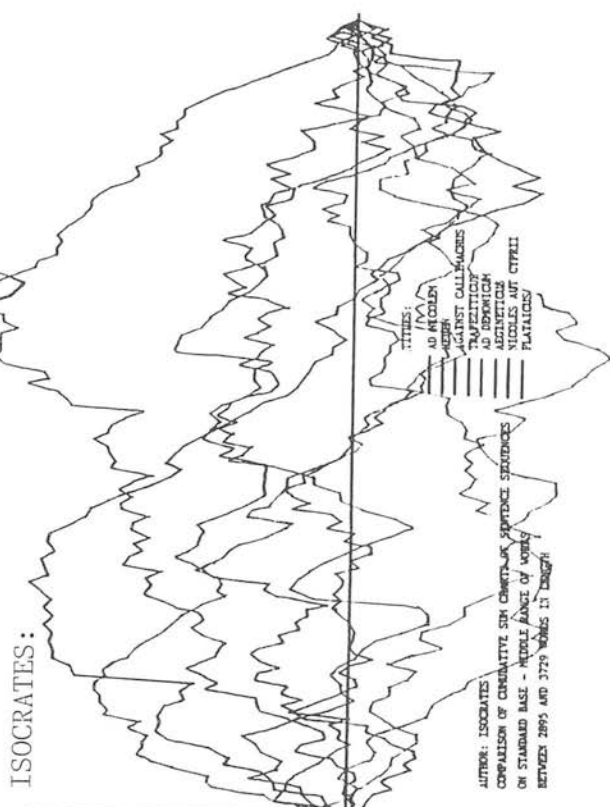
- |                                 |   |                          |
|---------------------------------|---|--------------------------|
| — ROMANS 1-14                   | — 2 TIMOTHY with 1:15 to 2:7 placed after 4:5 | — 2 THESSALONIANS        |
| - - - 1 CORINTHIANS 1:1-6:20    | - - - 1 TIMOTHY 1:1-5:7 (ex.3:1-16)           | — COLOSSIANS             |
| — GALATIANS 1:1-5:15            | - - - PHILIPPIANS                             | - - - EPHESIANS          |
| - - - 2 CORINTHIANS 10:1-12:19a | — 1 THESSALONIANS                             | — TITUS (ex.1:7-9,12-16) |
|                                 |   | - - - PHILEMON           |

● PRIMARY HINGE POINTS IN SCALING STRUCTURE

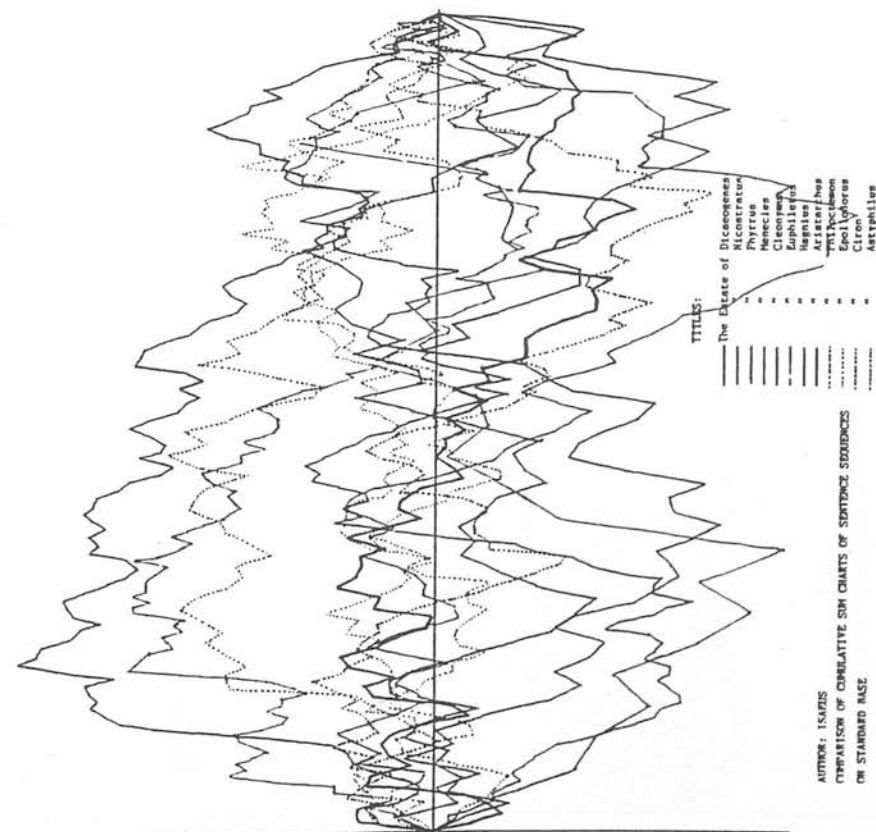
# IGNATIUS:



# ISOCRATES:

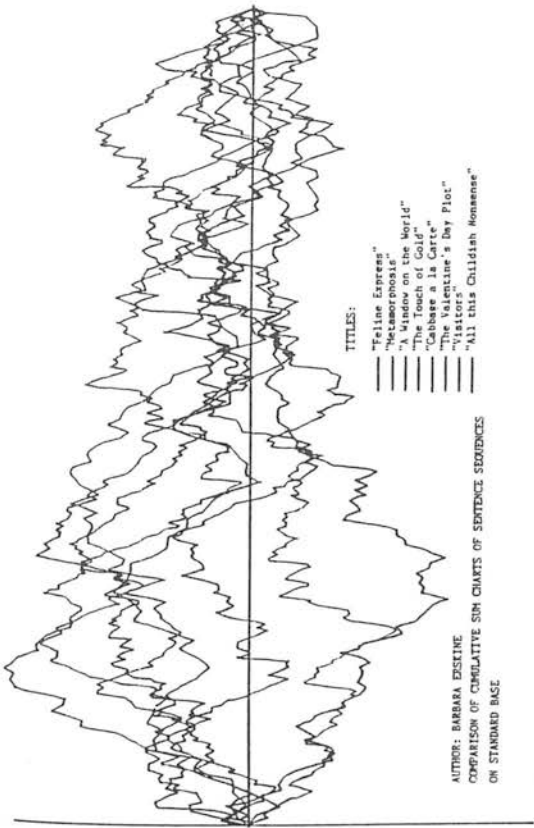


# ISAEUS:

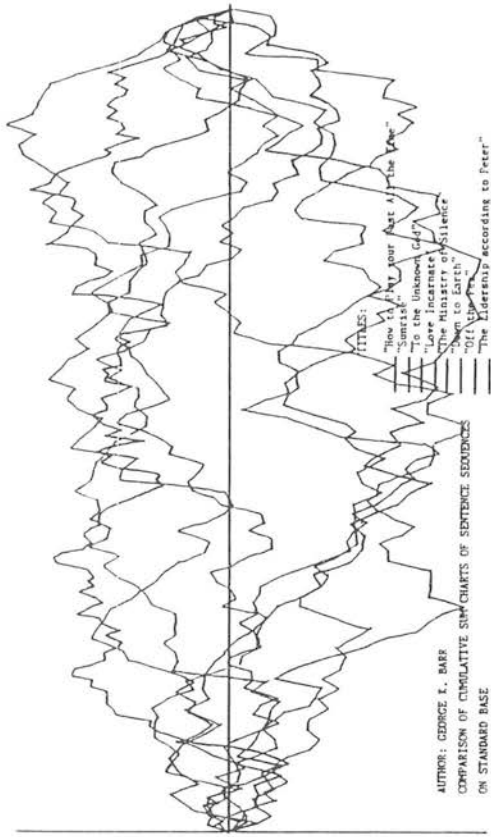




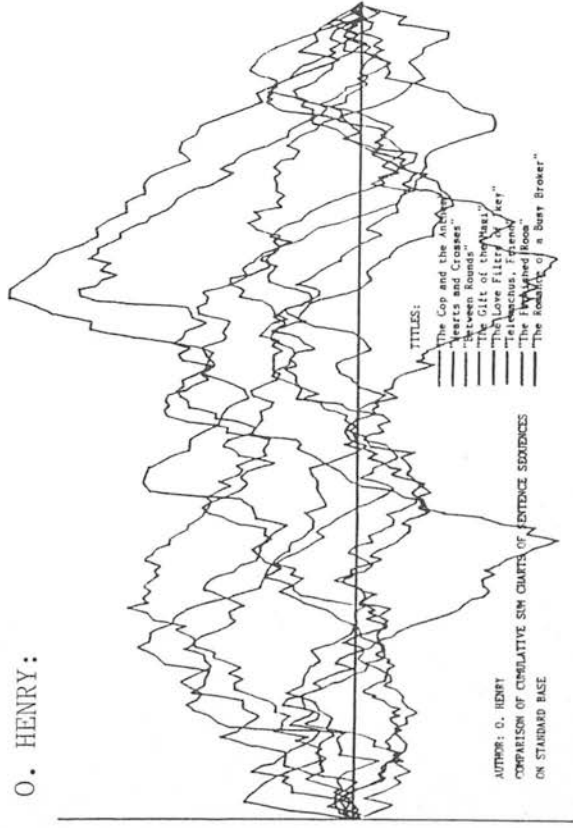
BARBARA ERSKINE:



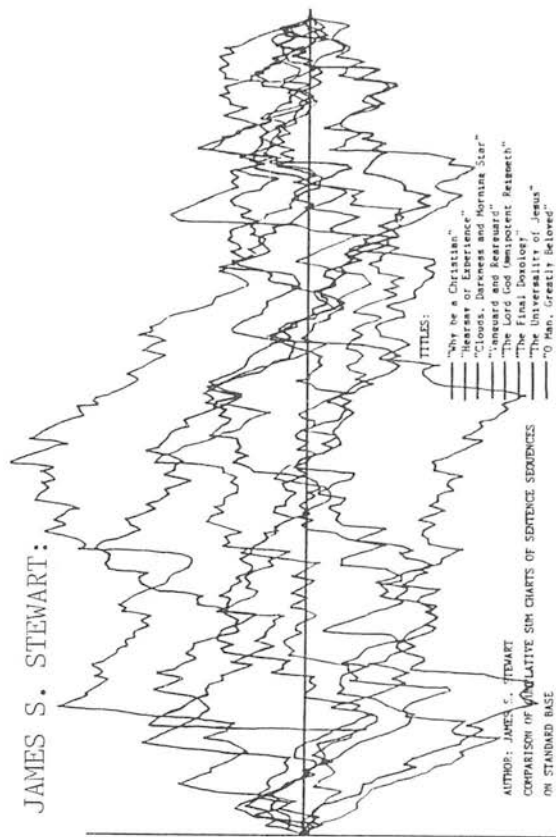
GEORGE K. BARR:



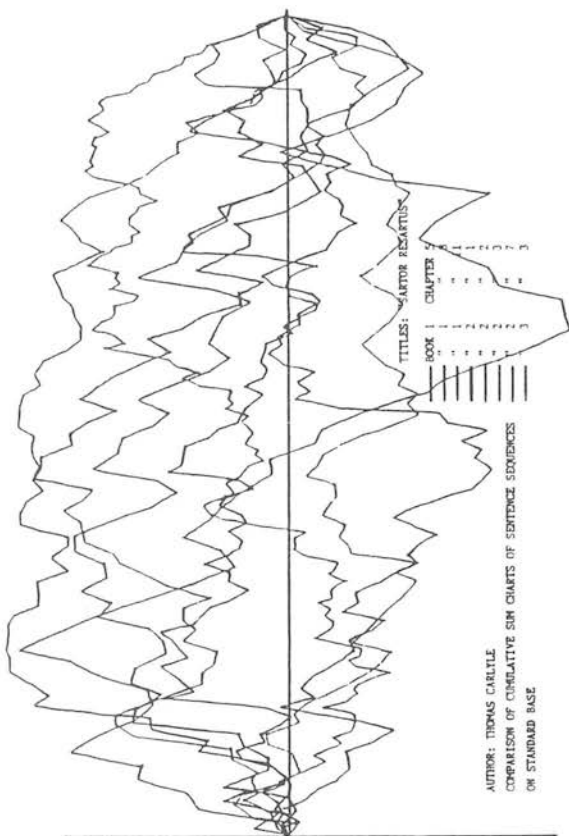
O. HENRY:



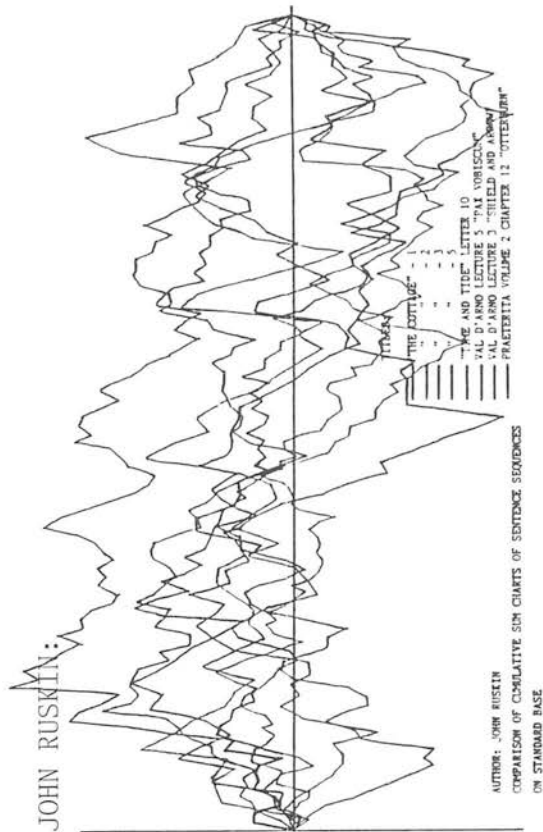
JAMES S. STEWART:



THOMAS CARLYLE:



JOHN RUSKIN:



providing the "skewed symmetry", the primary hinge points all lying in a line, the central notches and the thrusts into the B sections - all evidence of the strong rhythmic structure which runs right through the corpus. While the other authors occasionally provide motifs which occur from time to time, and while the several collages show different characteristics which are very hard to define, none of them show the kind of patterns which are sustained through whole works in the Pauline epistles. One cannot with certainty make deductions with regard to authorship from this, but there must be some significance in the fact that no comparable patterns have been found elsewhere in the graphs of over 423,312 words which I have prepared in the course of these studies.



## CHAPTER 6

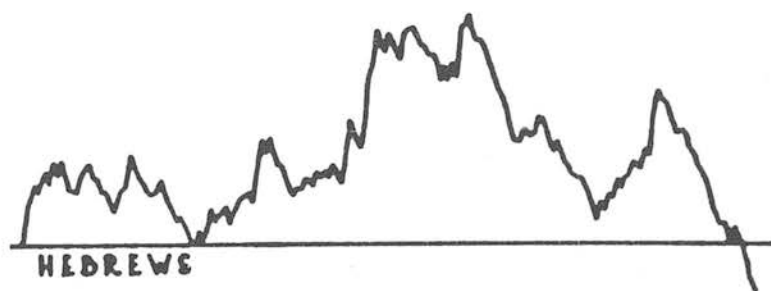
### Hebrews, 1 and 2 Peter and Jude

When the cumulative sum graphs of the sentence sequences in Hebrews, 1 Peter and 2 Peter are seen as a group, and that group is compared with the graphs of the other authors' works included in this study, it is apparent that the Hebrews/Peter group have some characteristics in common. These are difficult to define, but there is a similarity in texture, that is, in the local features of the graphs, even though they do not match closely over the whole length. The graphs on page 287, which are an early interpretation of the structure of these works, show that as a group they are quite different from the Pauline epistles. It was noted also that the ASLs of 1 and 2 Peter in Souter's version are almost identical.

These coincidences suggested that a search should be made for common patterns in these three works. I decided to use the UBS version with a minimum of adjustment, rather than attempt to repunctuate the texts. There is a large measure of agreement between UBS and Souter, and where they differ, the choice of one or the other allows a small amount of latitude in selecting a preferred text. Whichever option is chosen has the backing of reputable scholarly opinion. The texts were firstly examined section by section, according to the divisions in the UBS version. Then sections were combined in different ways in order to determine whether there were any repetitions of shapes at different scale levels. The major correspondence was found when the whole of Hebrews was compared with substantial parts of the other two works.

HEBREWS AND 1 AND 2 PETER

SENTENCE SEQUENCE GRAPHS



## 6.1 2 Peter

The second epistle of Peter is taken first as it provides the least complex of the sentence sequence graphs. The UBS text is used throughout. The graph is shown on page 289 and at the end of the epistle there is clearly an afterthought pattern which corresponds to the last three sentences in UBS, that is 3:14-18. The prime material ends at 3:13 with the vision of new heavens and a new earth in which righteousness dwells. The afterthought refers to the difficulty of understanding Paul's writings, and gives a word of exhortation and an ascription of praise. The text from 1:1 to 3:13 may be considered to be a prime pattern, though of a shape which is quite different from those encountered in the Pauline epistles.

## 6.2 Hebrews

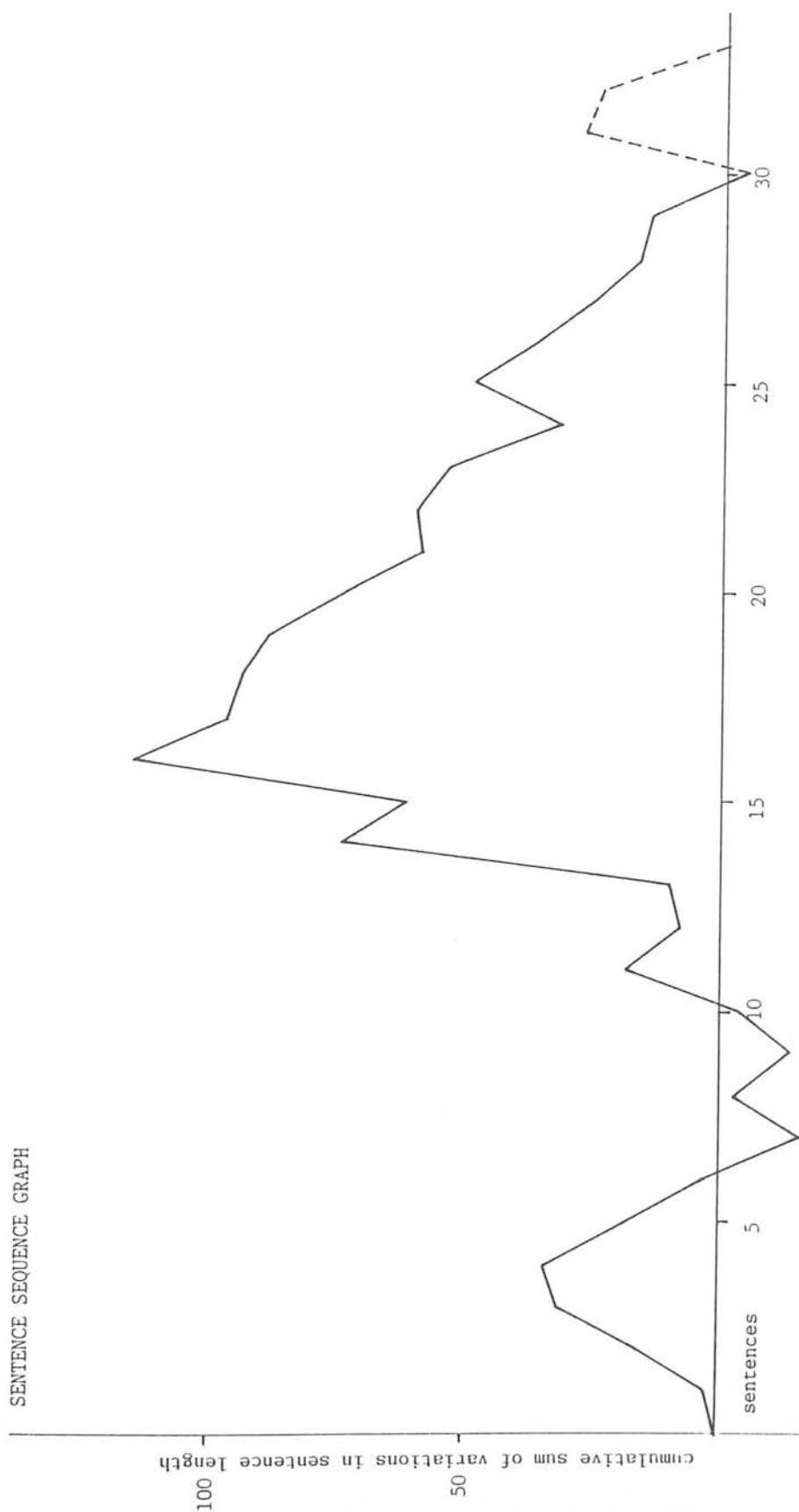
Quotations pose a problem, particularly in the first chapter. In dealing with these, several methods were considered:

1. Take the punctuation of the quotation as it stands. This introduces a pattern which is foreign to the author.
2. Consider the whole quotation to be one "sentence". This could result in the insertion of an untypically long sentence.
3. Divide the quotation where there is a clear change of topic within the quotation, and also where the author includes a short introductory clause. This appears to offer the best chance of achieving compatibility with the author's own habits.

Shorter quotations do not cause much difficulty as many of them are close to the ASL with minimal effect on the graph. Even shorter quotations may be assumed to be absorbed into the text.

The sentence sequence graph of Hebrews using UBS punctuation is shown on page 290. When Hebrews is compared with the <sup>other</sup> epistles, a difficulty arises due to the great difference in the lengths of the works. If the shapes are compared by drawing graphs on a common base, the local

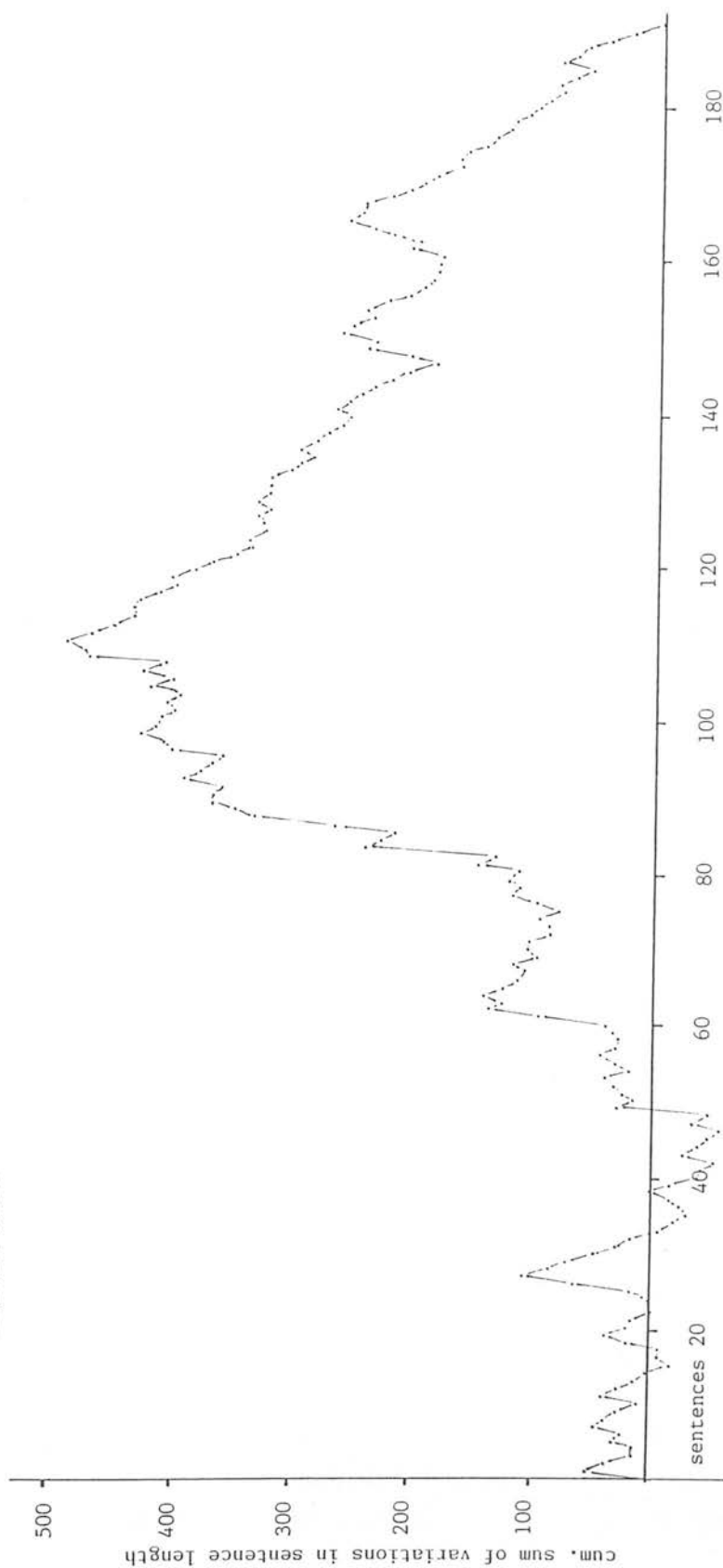
# SENTENCE SEQUENCE GRAPH



2 PETER, U.B.S. punctuation.

ASL: 33.30 WORDS: 1099 SENTENCES: 33

# SENTENCE SEQUENCE GRAPH



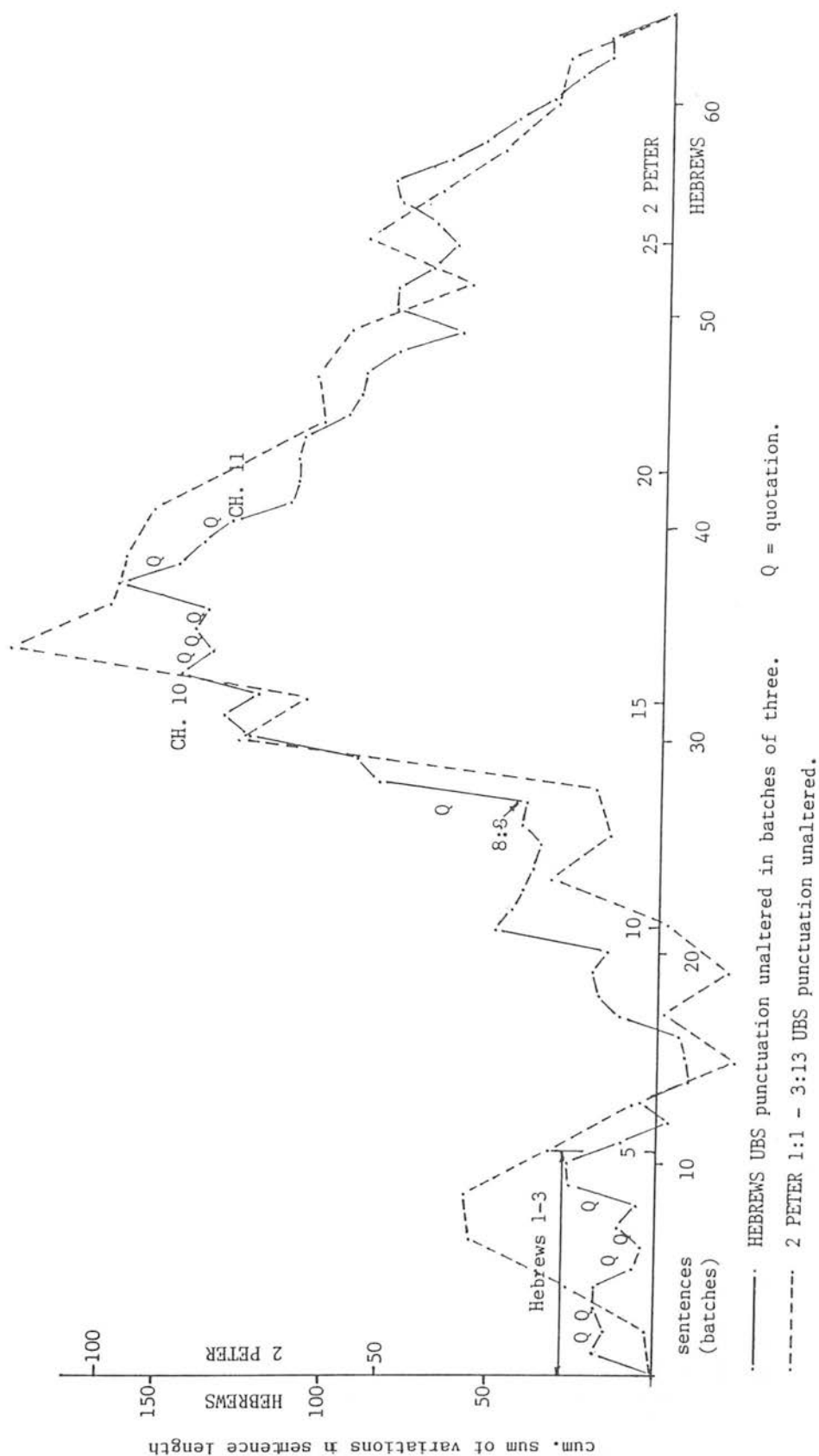
HEBREWS UBS punctuation

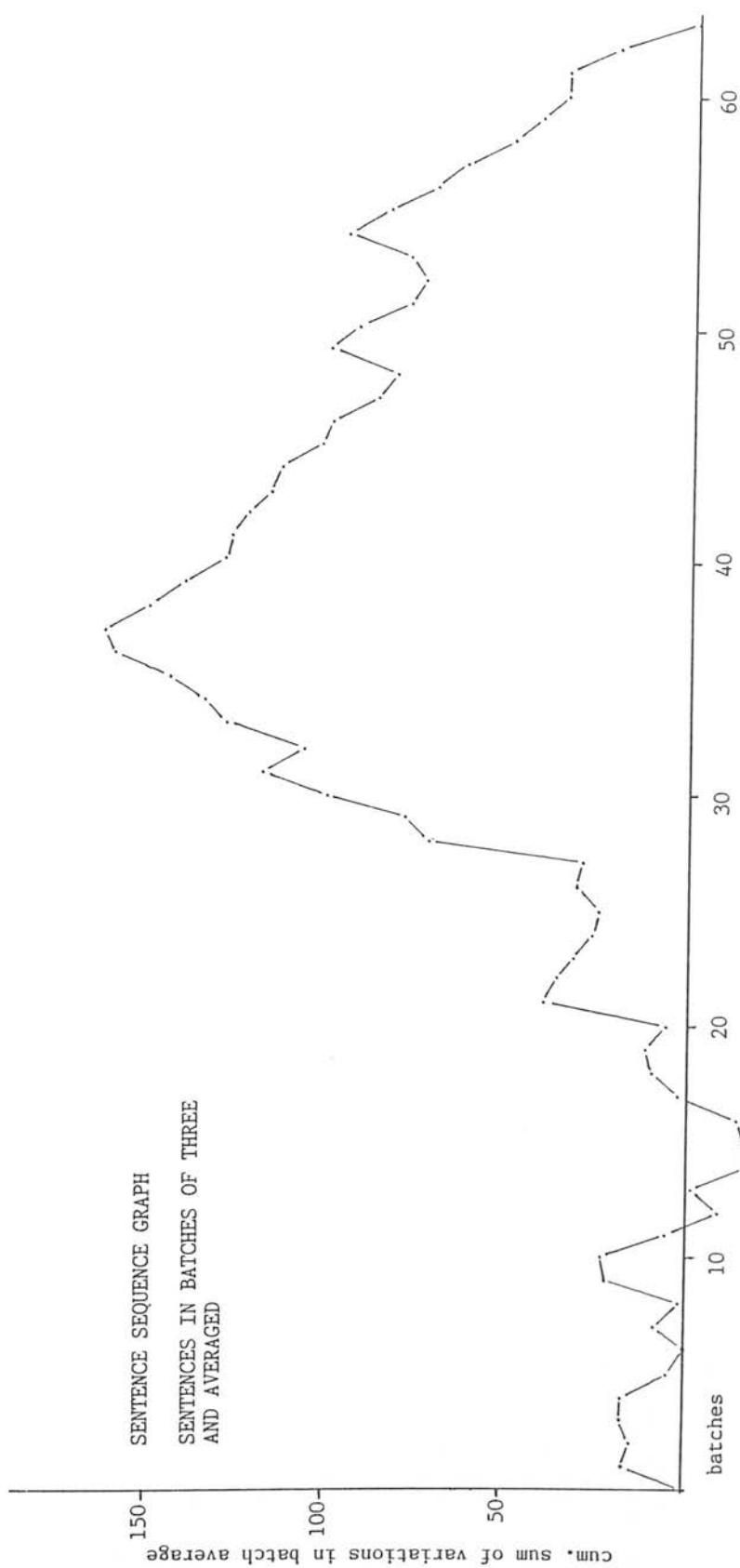
ASL: 25.93 WORDS: 4953 SENTENCES: 191

variations in sentence length produce a sawtooth pattern in the graph of Hebrews which is on a different scale from the variations in the graphs of the epistles. This fine pattern may be ironed out to show the underlying structure, by taking the text of Hebrews in groups of three, four or five sentences, and taking the average of these groups as "sentences". On page 292 the UBS graph of Hebrews is redrawn, taking the sentences in batches of three, and using the average sentence length of each group to construct the cumulative sum graph. As the number of sentences in Hebrews is not exactly divisible by three, there are two sentences in the first and last groups. The graph of Hebrews is compared with that of the prime pattern of 2 Peter, and it can be seen that they are similar in the major features. The greatest differences lie in the areas which are covered by Hebrews 1-3 and 10 where there are concentrations of quotations. Hebrews 1-3 poses a problem in that a very large part of the text is composed of quotations and little remains to establish the scale of the context. This anomaly is accepted, and no attempt is made to adjust these opening chapters: they remain something of an enigma, but affect only a small portion of the overall pattern. Both graphs show a central passage which is on a much larger scale than the rest of the epistles, and it seems probable that the quotations in chapter 10 are not in scale with their context and require to be grouped. The graph on page 293 shows the effect of taking 10:5-9a as one group and 10:30-31 as another. The effect is moderated by the sentences being grouped in batches of three. All other quotations have been left as they stand in UBS text, and are assumed to have been absorbed into the text.

## 6.3 1 Peter

The epistle falls into several sections, the first comprising Chapter 1 which is in the nature of an introduction in which the author sets out the "living hope", ending with "That word is the good news which was preached to you". There is then a change in direction, and 2:1-3:7 consists of exhortation to the members of the church to live as the People of God. The ASL of the second section is about the average for the whole letter. The graphs of 1 Peter using UBS and Souter's punctuation are shown on page 294, and it is clear that there are problems in assessing the scale of the sections of this letter. The graphs correspond at the beginning but diverge in the middle





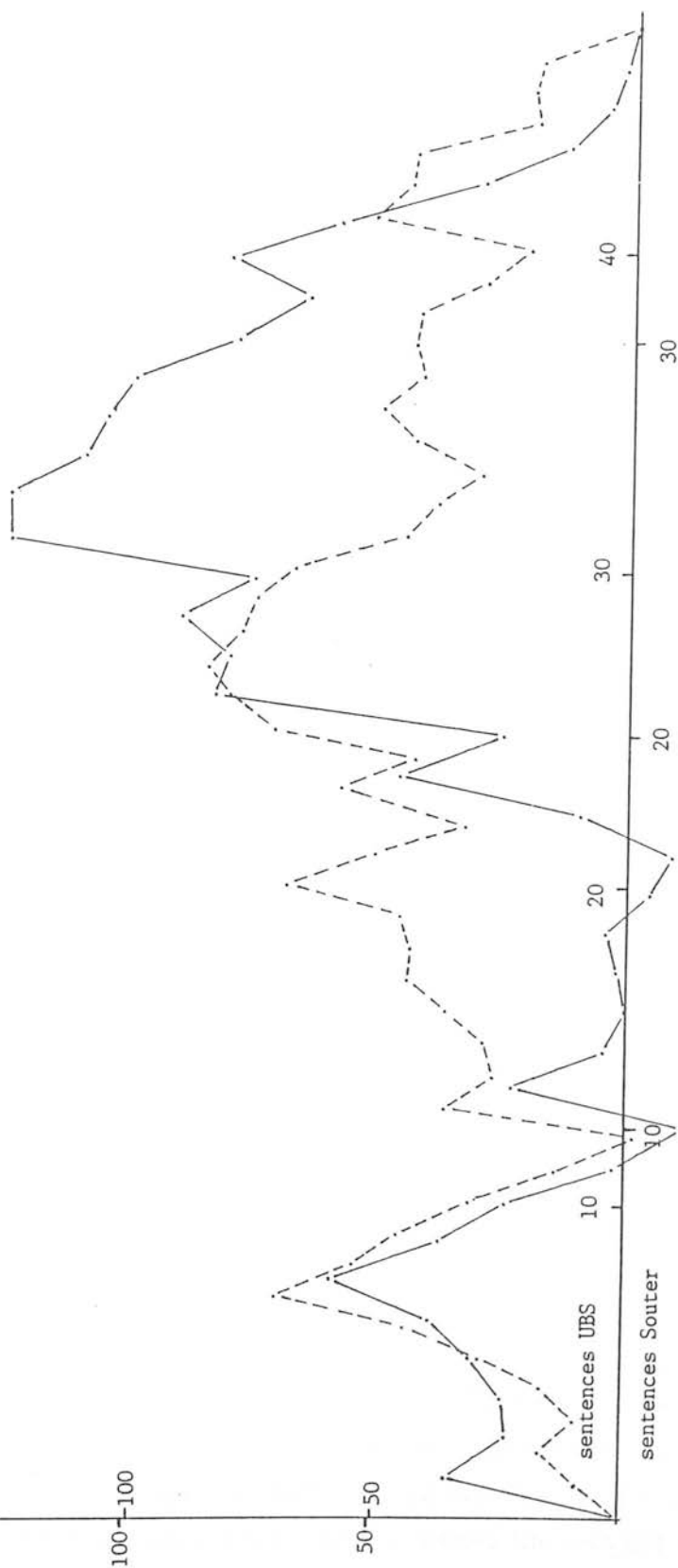
HEBREWS UBS punctuation. Quotations grouped at 10:5-9a and 10:30-31.

Sentences in batches of three and averaged (two in first and last group).



# 150-150 SENTENCE SEQUENCE GRAPHS

cum. sum of variations in sentence length



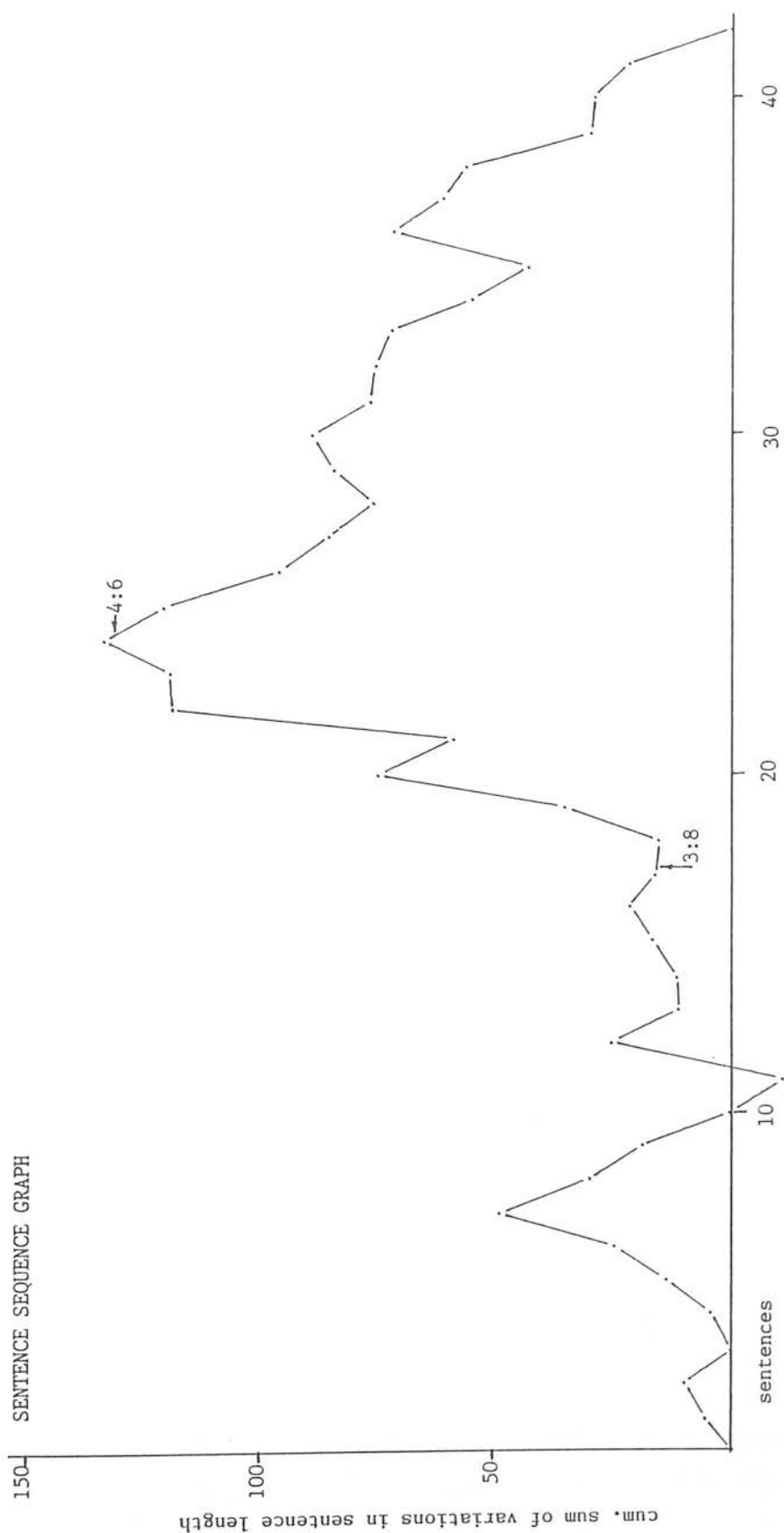
— 1 Peter 2:1-5:11 - Souter's punctuation

- - - 1 Peter 2:1-5:11 - U.B.S. punctuation

section. In the centre of Souter's version there appears a large scale section with a high ASL which is not so apparent in the UBS version. There is a difference of interpretation at this point. The passage runs from 3:8 to 4:6 and begins τὸ δὲ τέλος, "finally", marking the change of scale. The kernel of the message of the epistle lies in this passage - "Partakers of the Sufferings of Christ". The thrust of this section runs out at 4:5 or 4:6 and the change of mood occurs at 4:7 - "The end of all things is at hand". There the scale is reduced drastically as the author turns to the matter of practical behaviour for Christian people. UBS has failed to gauge the scale of this passage and has yielded to the temptation to divide long sentences. Souter, on the other hand, has continued the large scale treatment too far, right to the end of 4:11, taking 4:7-11 as one long sentence, having failed to detect the change in scale. The best scale relationship between the parts is therefore obtained by taking Souter's punctuation as it stands for the section 3:8 to 4:6, and UBS punctuation as it stands for the rest of the epistle. The graph of 2:1-5:11 showing the result is shown on page 296. The last three verses of Chapter 5 are greetings which form an afterthought patterns and are omitted, the prime pattern ending at the Amen of 5:11. Two questions are combined with adjacent sentences at 2:20 and 3:13.

## 6.4 Comparison of Hebrews, 1 and 2 Peter

The three epistles may now be compared. In 1 Peter the central large scale section contained the kernel of the message of the epistle. It can now be seen that the same is true of the other two epistles. In Hebrews, the first five chapters deal with what the author calls "the elementary doctrines of Christ" (6:1). The core of the message of Hebrews concerns the Priesthood of Jesus, and the figure of Mechizedek is reintroduced. The main thrust of the central section begins at 8:1 with the reference to Jesus as high priest, seated at the right hand of the throne of the Majesty, and it ends with a picture of the exalted Christ, his work of reconciliation accomplished, awaiting the final Triumph. This leads to the climax of the appeal in 10:19-25 - "Therefore, brethren, since we have confidence to enter the sanctuary by the blood of Jesus...." The central large scale section therefore runs from 8:1 to 10:25 and contains the kernel of the message of the epistle. In 2 Peter, the core of the message begins at 2:4 where the subject is the



1 PETER 2:1-5:11 - UBS punctuation except for block from 3:8 to 4:6 where Souter is followed.

ASL: 29,29 WORDS: 1230 SENTENCES: 42

Judgement of God. The surge of this passage subsides at 2:16 where it suddenly loses impetus and drifts to the end of the section at 2:22. These core passages occupy similar relative positions in each epistle and comprise a similar proportion of each work.

The graphs of the three epistles (page 298) show similar motifs, the main difference lying in the opening chapters of Hebrews which largely consist of quotations. There is no way as yet of classifying the series of motifs which form these patterns, but a purely graphical separation, unrelated to the content of the text, is made on page 299. The motifs vary in size, yet the shapes are recognisably similar.

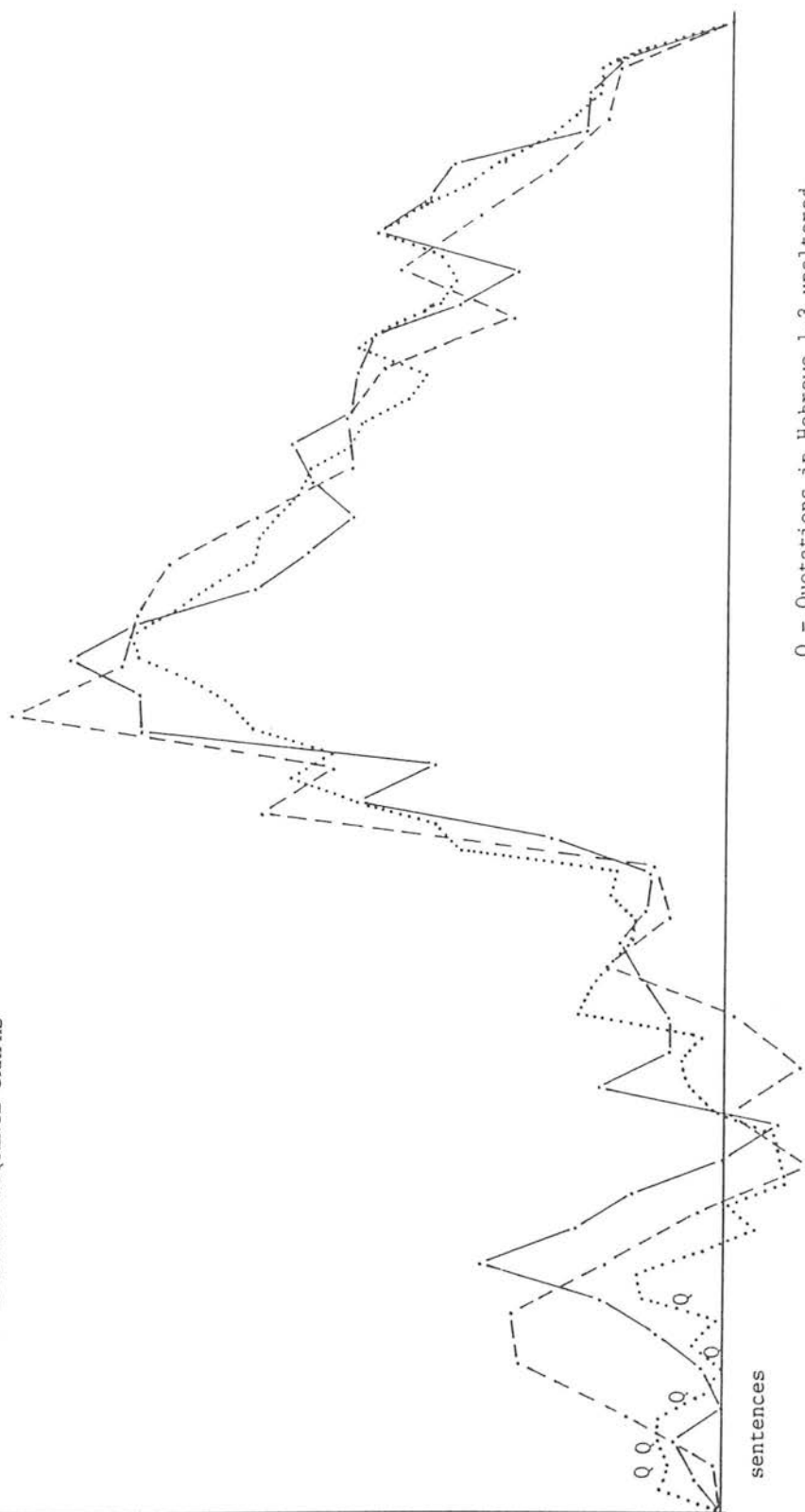
The adjustments necessary in the UBS text to achieve this degree of correspondence are slight. This is seen when comparison is made with the number of combinations of the variants which must be made if the closest match is to be obtained. While the texts of UBS and Souter are close, there are six places at which they differ in 2 Peter and eleven places in 1 Peter. To find the closest match between these two epistles would require 126,852 comparisons to be made. If the thirty six differences in Hebrews are taken into account, the number of comparisons necessary runs into many millions, far beyond the capacity of my computer programme. The adjustments I have made involve only the substitution of a total of five colons for question marks or full stops in 1 Peter, and four colons for full stops in Hebrews. Wherever a colon is used instead of a full stop, Souter has been followed except at Hebrews 10:31 where a small sentence has been linked with quotations.

It is rare to find such lengthy sequences showing such a degree of correspondence, and this may prove to be significant. On page 300 the graphs of Hebrews, 1 and 2 Peter are scaled to their respective lengths. For comparison, on page 301, a group of Pauline epistles is shown which exhibit similarity of shape preserved across similar differences of length and scale. Pages 302 and 303 show sequences in the works of Ignatius where similarity of shape is maintained over considerable lengths.

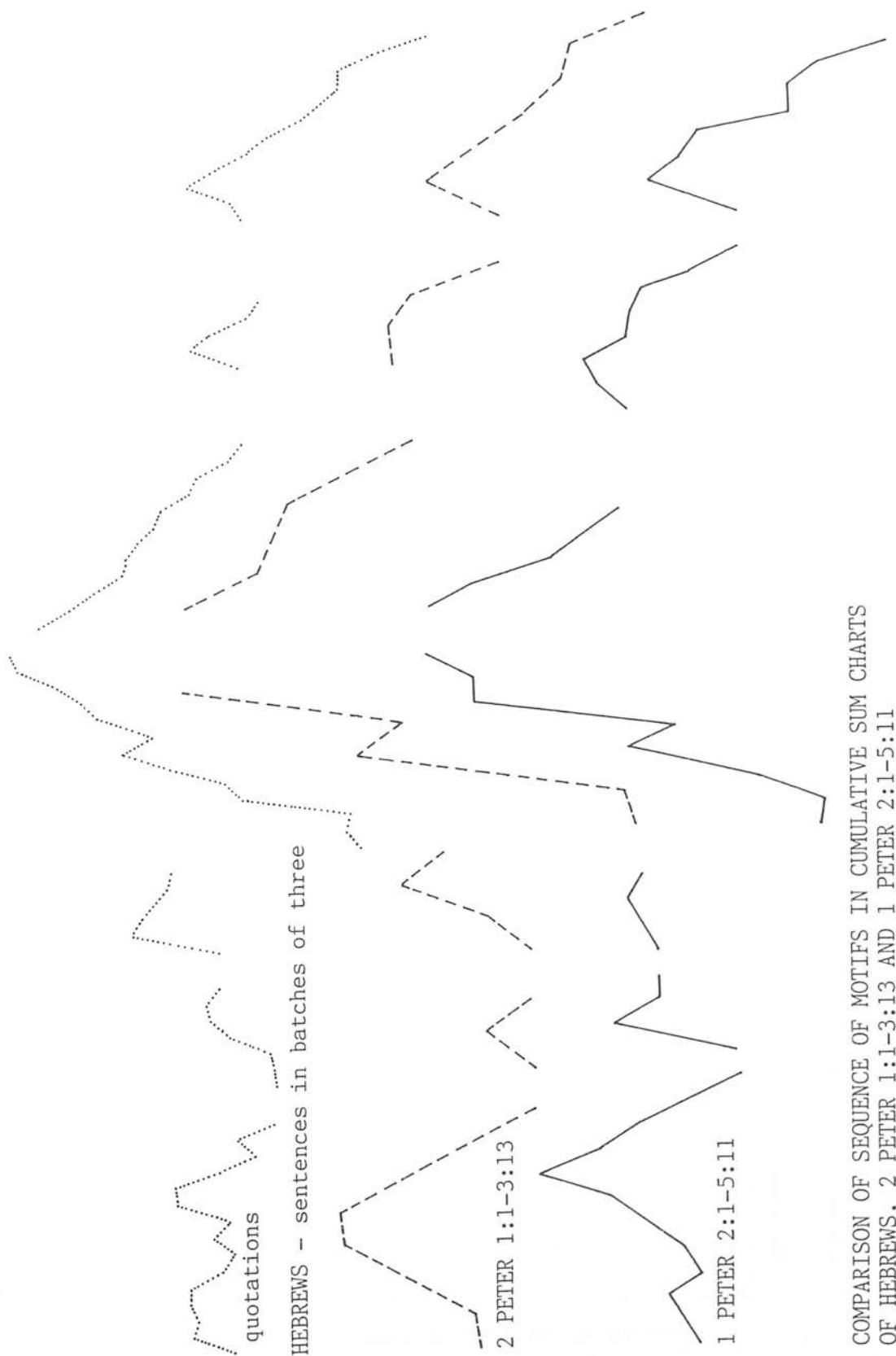
It is important to determine whether the occurrence of similar patterns in Hebrews and 1 and 2 Peter is fortuitous or significant. An examination was made of the graphs of all the works covered in this study, amounting to 423,312 words, approximately half being in English and half in Greek. The

# COMPARISON OF SENTENCE SEQUENCE GRAPHS

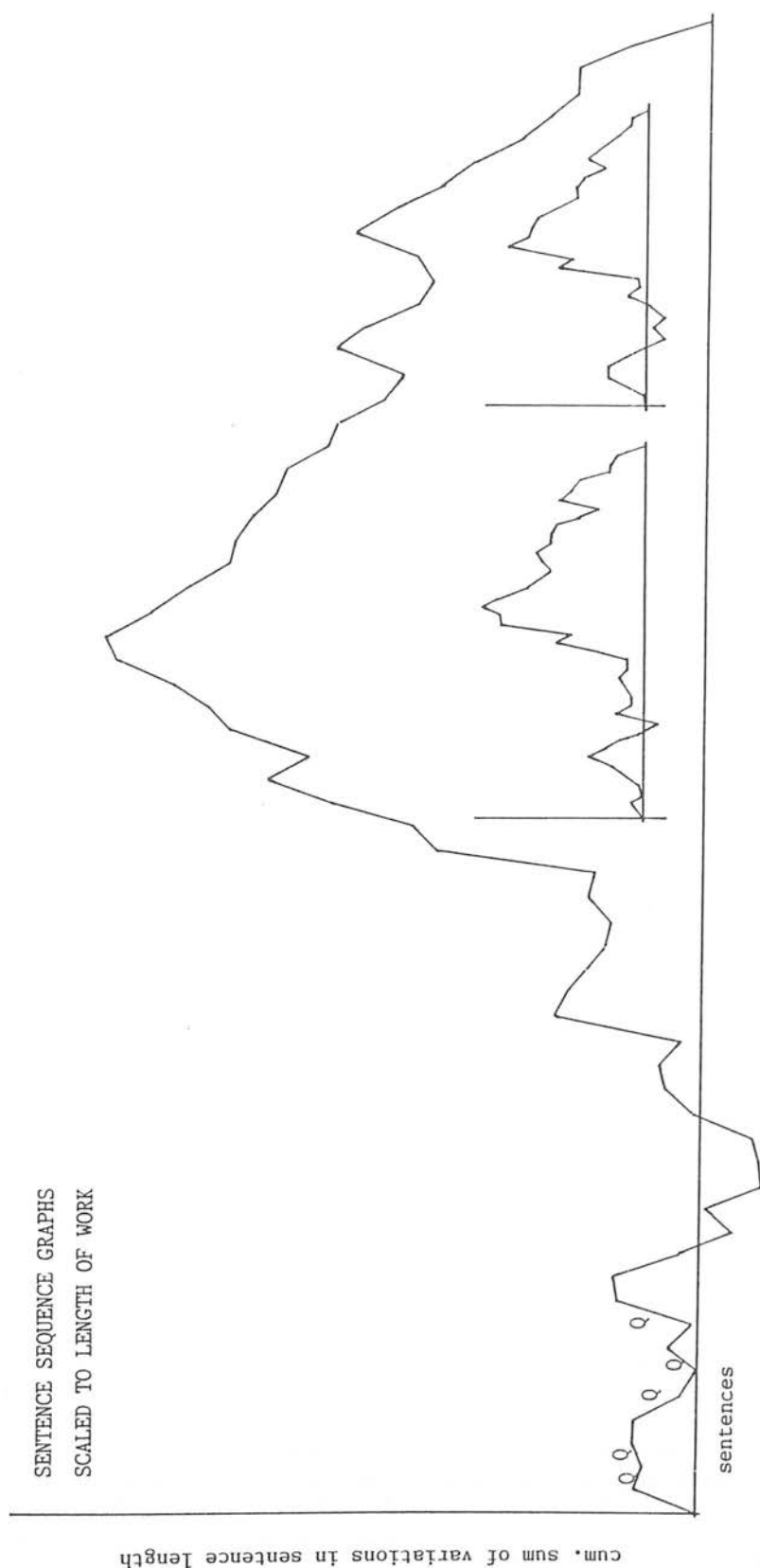
cum. sum of variation in sentence length (or batches)



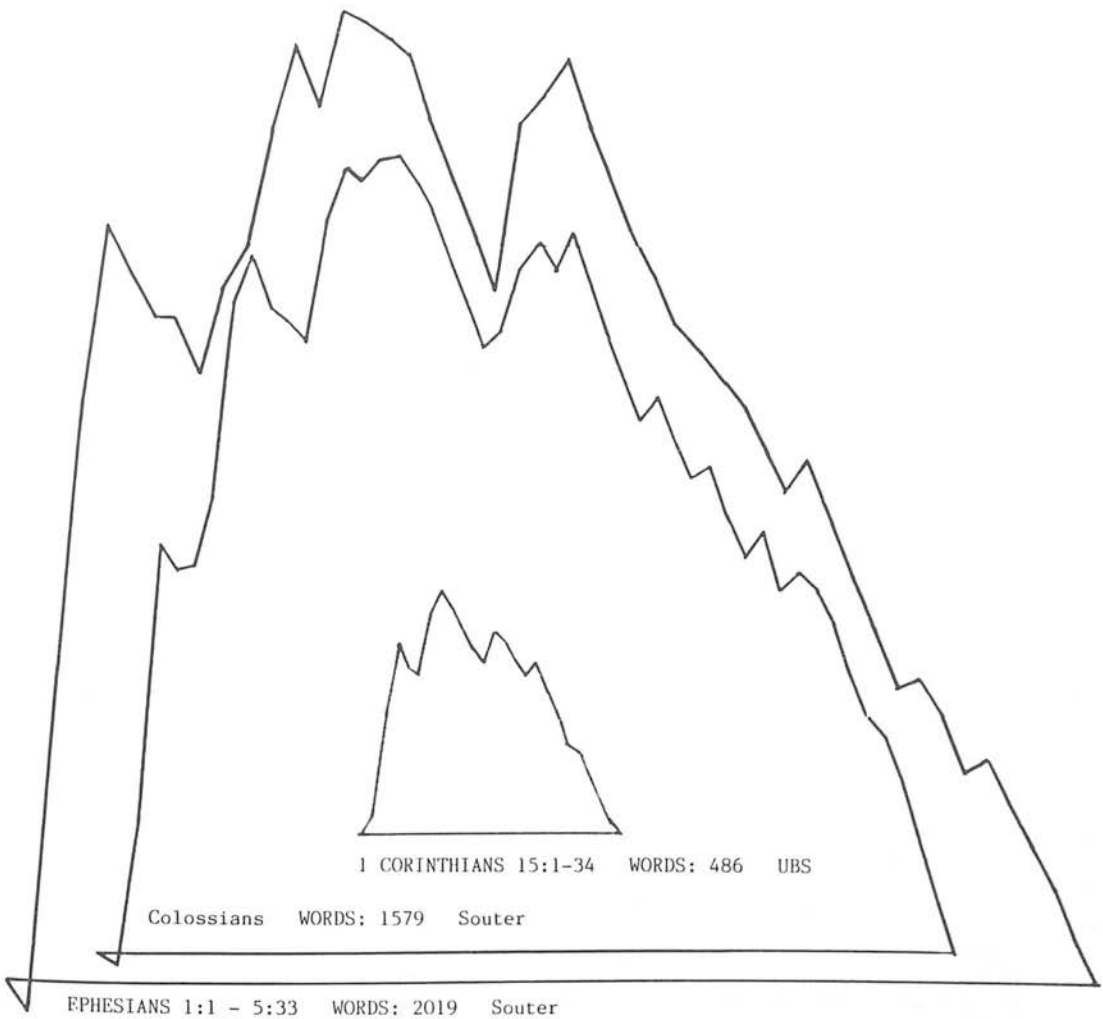
Q = Quotations in Hebrews 1-3 unaltered.  
 ..... HEBREWS UBS. Quotations grouped at 10:5-9a and 10:30-31. Sentences in batches of three, averaged.  
 — 1 PETER 2:1-5:11 - UBS except for block from 3:8 to 4:6 where Souter is followed.  
 - - - - - 2 PETER 1:1-3:13 UBS punctuation unaltered.



COMPARISON OF SEQUENCE OF MOTIFS IN CUMULATIVE SUM CHARTS OF HEBREWS, 2 PETER 1:1-3:13 AND 1 PETER 2:1-5:11



HEBREWS UBS punctuation. 4954 words.  
 Q = quotations unaltered.  
 Sentences in batches of three, averaged.



COMPARISON OF SHAPES AND SIZES OF PAULINE EPISTLES



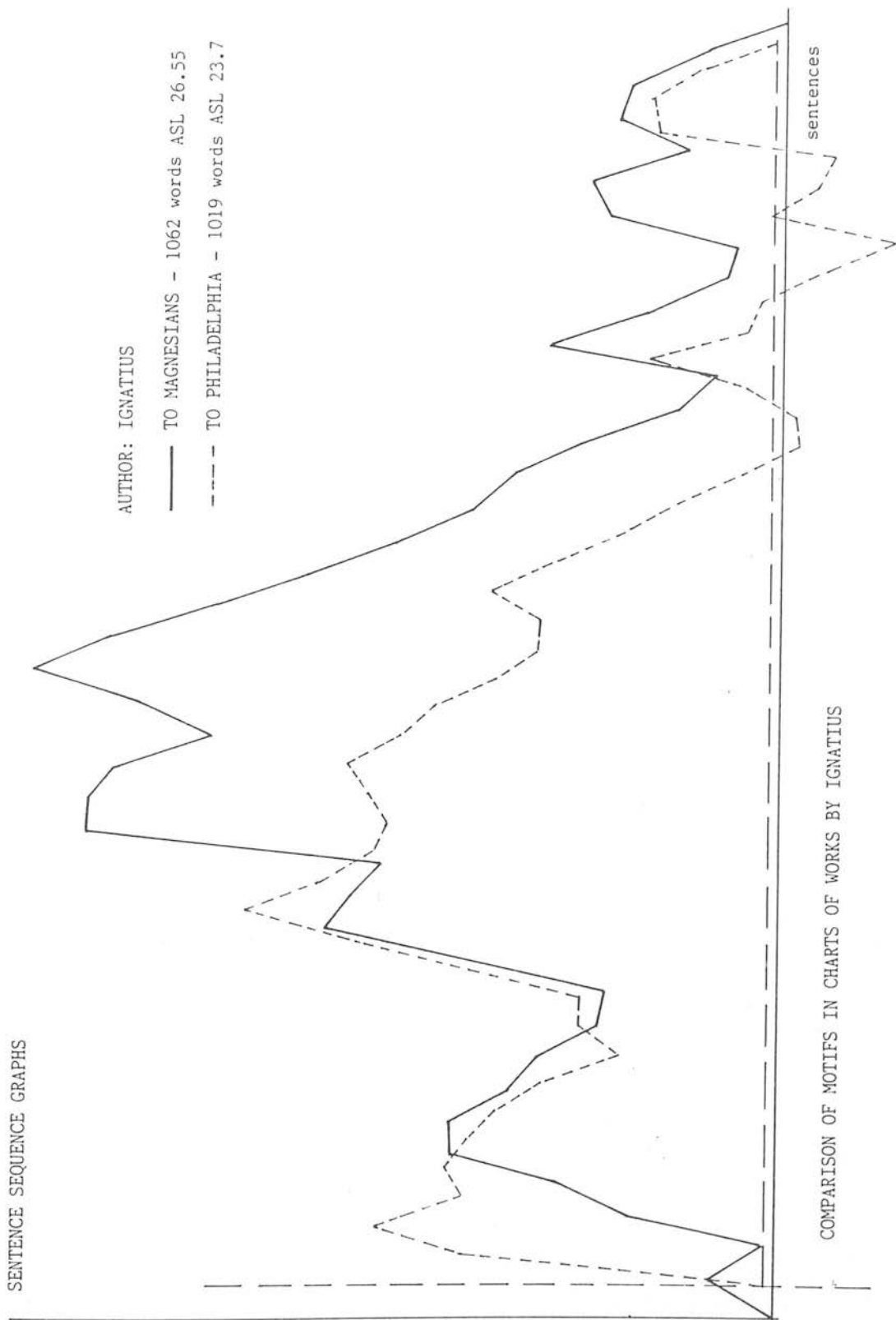
# SENTENCE SEQUENCE GRAPHS

AUTHOR: IGNATIUS

— TO MAGNESIANS - 1062 words ASL 26.55

- - - TO PHILADELPHIA - 1019 words ASL 23.7

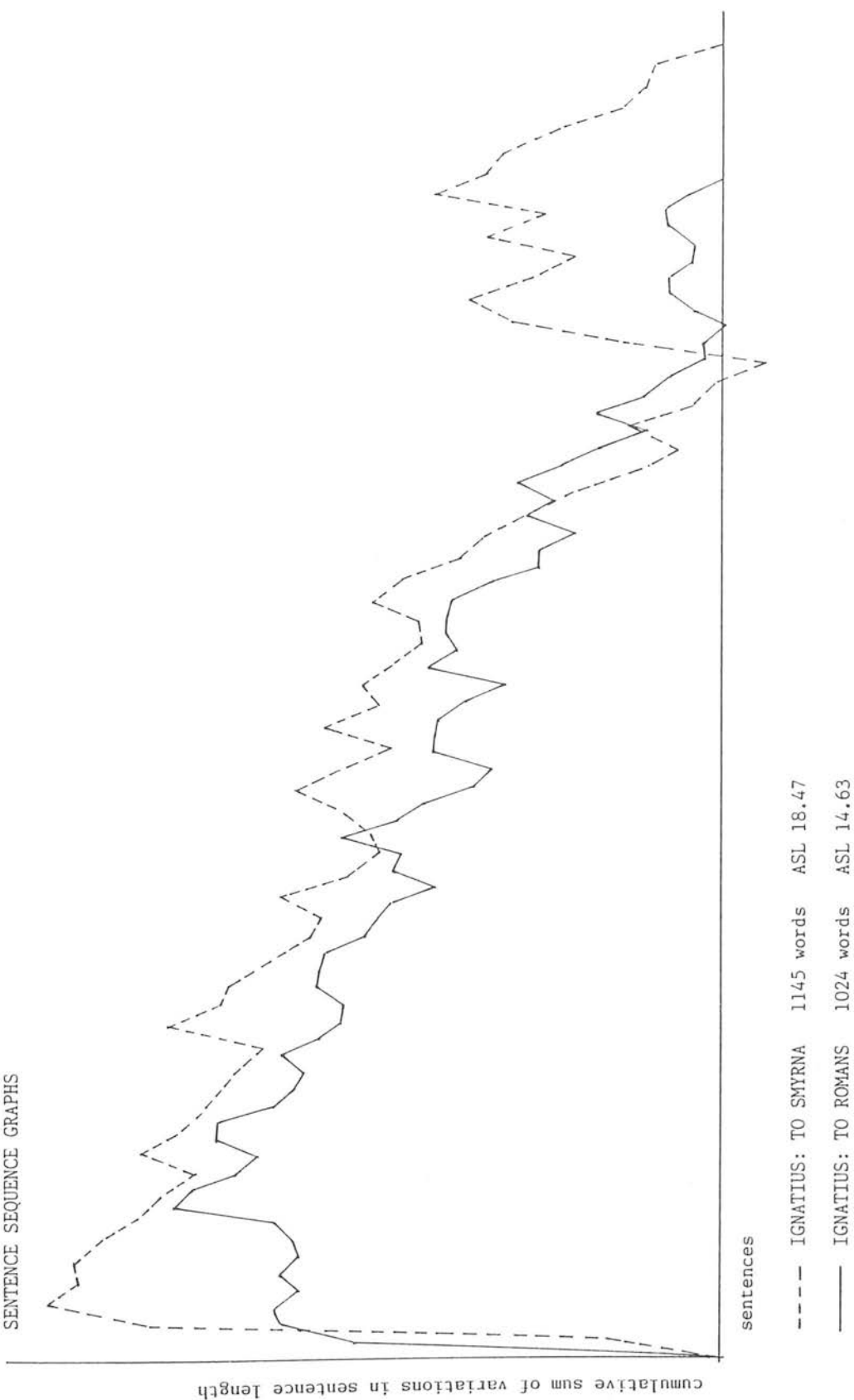
cumulative sum of variations in sentence length



COMPARISON OF MOTIFS IN CHARTS OF WORKS BY IGNATIUS

sentences

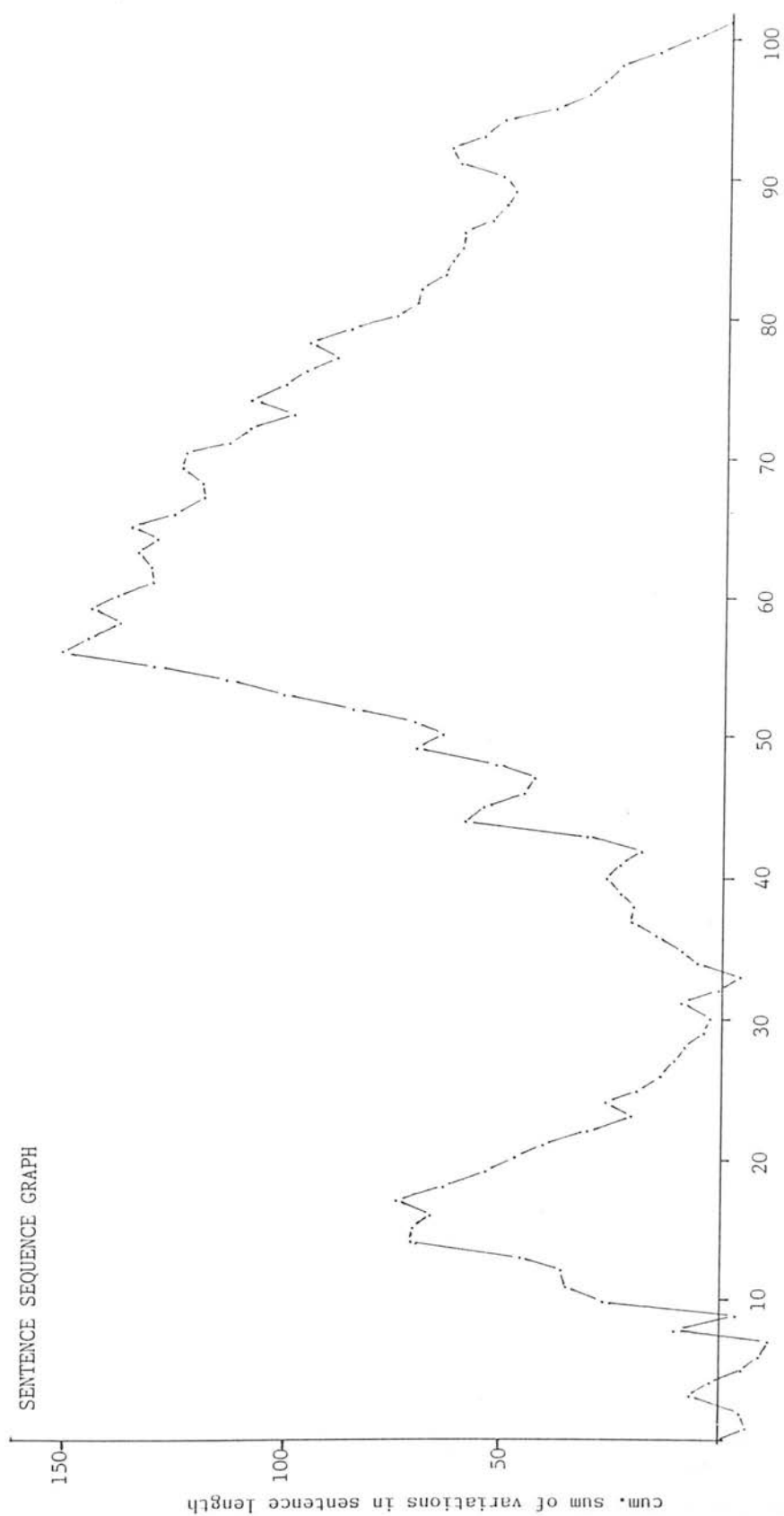
# SENTENCE SEQUENCE GRAPHS



scrutiny failed to detect any close match at any scale level. The nearest sequence so far discovered is a section of text lifted from a story by Barbara Erskine which bears no relation to the sections of the story. The graph is shown on page 305, and may be compared with those of Hebrews and the epistles on page 298. It is not a very good match although it has some general similarity. This is clearly fortuitous, and suggests that this kind of sequence might occur fortuitously less than once in every 400,000 words. The appearance of this sequence three times in three works totalling about 8,000 words must constitute a significant link between these works.

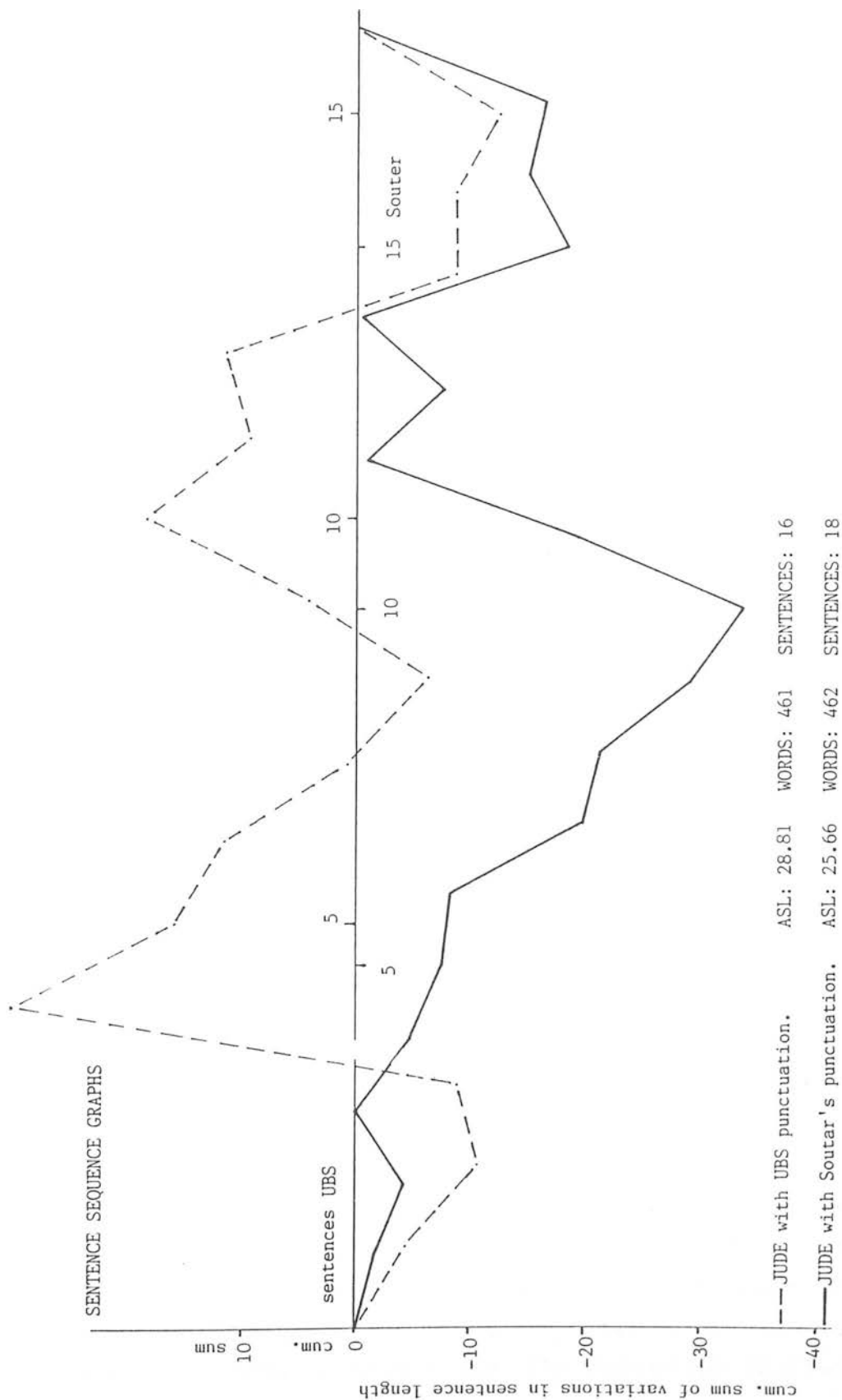
## **6.5 Jude**

Jude is mentioned at this point only because of the connections between the epistle and 2 Peter. Graphs of UBS and Souter's punctuation are compared on page 306. Despite the known connections between Jude and 2 Peter in terms of thought and vocabulary, there is no detectable relationship between the graphs of the two letters. If the author of one had the text of the other epistle before him as he wrote, any borrowing cannot be detected from the graphs. It is possible that the two letters may reflect shared discussion rather than the borrowing of written material.



BARBARA ERSKINE

EXTRACT FROM "A WINDOW ON THE WORLD" - Sentences 26-126.



# CHAPTER 7

## Discussion

These studies began with the observation that in the cumulative sum graphs of sentence sequences in the Pauline epistles, there appeared to be variations which might be due to differences in scale, rather than differences in authorship as Morton had alleged. The investigation into the works of both modern and ancient Greek authors revealed a kind of consistent pattern which I labelled a "prime pattern". There seemed to be grounds for holding that these patterns reflected material which had been marshalled in the mind of the author and written out or dictated in one operation. Other material, produced more spontaneously, tended to give a series of small patterns related to individual topics; such patterns are found in 1 Corinthians 7-16 and 2 Corinthians 1-9. In the Pauline epistles, these prime patterns assumed several forms, but the principal contrasts were always present. The mathematical model showed how these various forms might be related to one another. They all possess the same basic qualities of "skewed symmetry", and the differences are due to the amount of fine detail which may be developed within a given length of text, coupled with a particular set of ASLs for the different sections.

In the Hebrews/1 and 2 Peter group, similarities of a different kind were found. The graphs of these epistles were each found to contain a series of very similar graphical motifs, comprising the whole or substantial portions of each epistle. Together, these cover some 8,000 words of text, while the only comparable repeat patterns found in 400,000 words of test material occur in groups of works with a common author. The proposal that Hebrews

and the Petrine letters come from the same hand, is one that has not found support in traditional scholarship, yet this evidence demands an explanation.

These prime patterns of the Pauline epistles, and the rather different patterns in Hebrews and 1 and 2 Peter, provide hard evidence of a kind which has not hitherto been available. They have not been detected by statistical method, and generally statisticians have tended to attribute lack of statistical homogeneity to differences of authorship. When scale is taken into account, however, the similarities at different scale levels are apparent. These features in the intermediate range, that is, between sentence size and the size of whole works, may frequently be related to problems which have been the concern of linguistic and literary scholars.

It is not the purpose of this thesis to rewrite the Introduction to the New Testament, but clearly these consistent prime patterns provide important new evidence, which may be considered along with evidence derived from other sources, in considering questions such as:

The extent of the original version of Romans - 14, 15 or 16 chapters.

The analysis of the Corinthian correspondence.

The integrity of the epistle to Galatians.

The relationship between Ephesians and Colossians.

The effect of hymnic material in Philippians and Colossians.

The peculiar structure of 1 and 2 Thessalonians.

Extraneous material and displacement in the Pastoral Epistles.

The authorship of the Pauline epistles generally, and of Hebrews and 1 and 2 Peter.

These cannot be examined in any depth within the compass of this dissertation which is concerned with establishing the existence of scale in literature and taking the first steps in quantifying its effects, but the detection of these patterns opens up new fields to be explored in the future.

## **7.1 The Origin of the Prime Pattern - 1**

### **In the Pauline Epistles**

It is now necessary to explore the possible origins of these patterns which allow these epistles to be grouped in this way. Several possibilities are explored - the influence of modern editors in punctuating the ancient texts, of the researcher in his interpretation of the punctuation; the possible use of conventional epistolary forms; the part the secretary may have played in the writing of the epistles; the theory that a school of Paulinists was responsible for the writing of the disputed epistles; and lastly, the possibility that the epistles come from the hand or from the mind of a single author.

#### **7.1.1 The Editor and the Researcher**

The possibility has been considered that prime patterns have been created by the editors of the modern versions during the process of punctuating the text. If that were the case, then a reason would have to be found why the system of patterns found in the Paulines is not found in letters by other authors. The patterns in the Hebrews/1 and 2 Peter group are quite different from those of the Paulines. There is no indication of Pauline types of prime patterns in any of the catholic epistles, nor in the letters of Ignatius. If these patterns were simply due to punctuation, then they might be expected to appear in non-epistolary writings such as the forensic speeches of Isaeus or the writings of Isocrates, but no similar patterns are to be found in these works. It must be concluded that the punctuation of the texts by modern editors plays little or no part in the formation of these patterns.

The next possibility must be that the prime patterns are a creation of the researcher and result from his selective approach to punctuation. My thesis is that there is inherent in the unpunctuated Greek texts, a pattern of pauses which is only imperfectly reflected in the punctuation of modern versions of the texts. At an early stage I attempted a fresh repunctuation of the epistles to give a truer expression of the scale inherent in the various sections. While this was an interesting exercise, it had no defence against the charge of subjectivity. In these present studies, I have used the texts of UBS and Souter, and found that there is a large measure of agreement in the



location of the principal stops. Where I have preferred one or the other, the chosen version has the backing<sup>of</sup> reputable scholarship. Only very occasionally have I elected to propose a different punctuation, and in each case I have given clear reasons for such a decision. In several important epistles, very little adjustment is necessary. The greatest problems arise in Romans, 1 and 2 Corinthians and Galatians, where the author's habit of stringing short questions together creates a mismatch with the scale of the context if the questions are taken as separate sentences. (A similar problem arises with quotations, especially in the first three chapters of Hebrews where there is little context to give a measure of the scale. That particular problem in Hebrews 1-3 I have accepted as an anomaly, and propose no solution; in the other cases I have given reasons for the grouping of quotations.) In Chapter 5, I have given lists of all the groupings of questions in the Paulines. There is no escape from the problem of grouping questions to secure homogeneity of scale, and the reader must judge whether the groupings I have made are justifiable. As a check, the questions were grouped mechanically to form word groups with each other or with the immediate context, to provide units which would be as near as possible to the ASL of the context. This simply minimises the effect of the shorter questions; it does not affect questions which are close to the ASL in length. While it resulted in some odd local patterns (page 192), it did produce overall shapes with similar features to those which were obtained by the first method which gave consideration to syntax and content.

The model was based on the remarkable consistency which was found in the placing of the λοιπόν markers and the points of transition from one genre to another. The characteristics of the opening stepped pattern, together with the observed contrast in scale between the first halves and the second halves of the epistles in the Ephesians/Thessalonians group, provided the mathematical elements of the model. It must be significant that while this model was based on features found in the Ephesians/Thessalonians group, its higher levels provided schematics for the epistles of the Romans/Galatians group. The model, therefore, in no way creates patterns; it simply mimics the patterns found in one group, and the correspondence of other levels of the model with the patterns found in the other group, shows that the difference between the groups is one of degrees of complexity and not of kind.

While the problem of punctuation is inescapable, it has not proved to be as difficult as was at first thought, as the important main features of the scaling pattern are found in several of the epistles without any significant alteration being made to the modern texts. It is important to realise that the punctuation of these versions does in many cases come near to the inherent pattern of pauses in the unpunctuated text, but that this near correspondence is destroyed to a considerable extent when the text is subdivided for statistical purposes at every colon, question mark and full stop.

I would hold, therefore, that the adjustments which I have made to punctuation are reasonable and logical, and do give a text which has a greater degree of homogeneity with regard to scale, and reflects more truly the flow of the author's dictation. The prime patterns are not artificially created by these adjustments, but reflect patterns which are inherent in the texts.

### **7.1.2 The Epistolary Form**

It has been suggested that the prime patterns in the Pauline epistles may be a direct reflection of a common epistolary form, rather than a reflection of authorship. The problem is to determine precisely what that common form might be.

Establishing a Pauline standard of form, style and diction is the work of the statistical stylometrist, and results produced over the years have been varied and inconclusive. Morton requires about six authors to cover the Pauline corpus: Kenny requires one or two. Morton's thesis is that any secretarial influence may be safely ignored and that in general, lack of statistical homogeneity is due to differences in authorship. Kenny envisages an author who is unusually versatile, who can embrace a wide range of stylistic features. Nowhere do these statistical studies, some of which cover hundreds of features, point to a set of stylistic characteristics which might account for the consistency found in the prime patterns of the Pauline epistles. It must also be considered whether literary forms and styles in use in the first and second centuries might provide a framework by means of which an author writing pseudonymously might achieve a prime pattern comparable with those of the Pauline epistles.

E. Randolph Richards in his book, *The Secretary in the Letters of Paul*, [55] attempts to classify the Pauline epistles with regard to ancient letter writing. Two main divisions in ancient letter writing have been proposed, and Richards refers to the Deissmann debate and the classifying of the Pauline epistles as "Literary or Non-Literary" [55, p. 211]. The distinction is between natural, daily, situational letters (*Briefe*) and artificial, artistic literary epistles (*Episteln*). The occasional papyrus letter was intended to be read by no one but the addressee, whereas an epistle was written to convey a fact or an opinion to a wider public. Deissmann recognised that a "letter" could become an "epistle" if it contained material of general interest and was circulated or copied. He would relate Paul's writings to the occasional papyrus letter, rather than to the literary epistle, calling them "artless and unpremeditated" [55, p. 212]. In that judgement I would have to disagree, as the complexity of the prime patterns gives evidence of considerable forethought in the arrangement of material. In comparison to the works of other ancient letter writers, Paul's epistles are substantially longer. The average length of the Pauline epistles is 2,495 words, compared with an average of 295 for Cicero and 995 for Seneca [55, p. 213]. His range is very wide, from 335 words in Philemon to 7,114 in Romans, yet the common scaling structure is found right across the range. Paul's epistles fit neither the category of *briefe* nor that of *episteln*. His epistles are not addressed to individuals (except in the case of Philemon), but to congregations. There is evidence (Colossians 4:16) that letters were to be passed round other congregations. They are written in a Hellenistic Greek which has literary features but which is not used with particular literary intent.

Richards shows that with regard to purpose, structure and content, Paul stands within the Graeco-Roman letter tradition. The customary forms, however, are adapted to suit Paul's purpose. As Kümmel indicates [36, p. 248], the prescript, proem, formulae and paraenesis have undergone considerable modification. Paul develops the opening and closing sections, "Christianising" them. He follows closely neither Jewish nor Hellenistic conventions. In Paul's hands a conventional Graeco-Roman epistolary formula conveying greetings or thanksgiving may be expanded into a prayer of intercession.

Paul employs many of the literary devices commonly used in Graeco-Roman letters such as analogy, chiasmus (both in sense lines and

thematic development), parallelism, antithesis, tribulation lists, virtue and vice lists, but these consist of small textual units, and do not influence the whole structure of the epistle to a sufficient degree to account for the prime patterns. Nor is there evidence of combinations of such elements occurring with sufficient frequency to do so.

Paul also employs oratorical devices such as paraenesis, diatribe and oration. The element of oratory is very evident in Romans and Galatians. Romans might be classed as a diatribe as its main purpose is to address a theological position. None of these elements occurs with sufficient regularity throughout the corpus to account for the prime patterns.

Certain letter-types may be present in Paul's writings. Richards points to Romans 16 as an example of the *litterae commendaticae*, but as this falls into an afterthought pattern in the graph of Romans it is scarcely relevant. Galatians may be held to be an apologetic letter and to represent a highly structured form of classical rhetoric, but this cannot be the source of the common pattern which is shared by the other epistles.

Attempts to classify Paul's writings in terms of features observed in other writings of the time, show that Paul uses many conventional devices and develops many of them in new ways, but provide no common structural system which could account for the prime patterns. It must therefore be asked whether the Pauline epistles themselves provide a common "epistolary form" which might be detected and used by later pseudonymous writers.

The basic structure suggested by Richards [55, p. 137], consisting of opening, body, and closing sections, is not helpful, as the opening and closing sections may form an almost insignificant part of the pattern in a long letter, and a considerable part of the shortest letter. Of far greater importance is the structure of the letters which has been observed in Chapter 5 - in particular, the strong contrast in scale between the A and B sections of the graphs. The question must be asked whether it is conceivable that such contrasts could be detected and imitated by other authors. It is highly unlikely that authors of the time would think in terms of sentence length or scale, but it is possible that these features might be associated with changes of genre. A change, which might be described in general terms as a change from the theological to the ethical, occurs at or near the hinge points in

Ephesians, Colossians and 2 Thessalonians. That might be sufficient to account for a pattern which other writers might unconsciously mimic if they were following the general layout of these epistles. But that particular contrast is not found in other epistles.

In Romans, the hinge point coincides with a different kind of change in theme, as Paul turns from consideration of the Law, to the consideration of Grace. Likewise in Galatians the hinge point coincides with the point at which Paul turns from the Law to Faith.

In the prime pattern of 1 Corinthians 1-6, Paul is at first on the defensive against criticism of his role, and the hinge point occurs at 4:5 where he says that judgement is in God's hands. In the prime pattern of 2 Corinthians 10:1-12:19a Paul again begins by answering criticism, and the hinge point comes at 11:24 with the list of Paul's sufferings.

In Philippians there is no very obvious contrast in subject matter or genre, and the hinge point comes at the first τὸ λοιπὸν at 3:1. Yet despite the lack of a clear change of subject or genre, Philippians is the most structured of the epistles in terms of scale. The second τὸ λοιπὸν is precisely related to the first within a complex scale structure (page 197). In this case the scale structure is not related to any observable epistolary form.

In 1 Thessalonians the hinge point occurs at the λοιπὸν οὖν of 4:1, and there is no clear distinction between the genre of the first part of the letter and that of the latter part. In 2 Thessalonians the hinge is at the τὸ λοιπὸν at 3:1 and there is an enormous contrast in scale between the two parts.

The Pastoral epistles in their adjusted forms (pages 265ff.) and also Philemon, have characteristic prime patterns, but although the hinges occur at important texts, there is no obvious change in genre such as is found in Ephesians, Colossians and 1 Thessalonians.

There is therefore no obvious epistolary pattern, either in terms of the traditional forms used in the first and second centuries, or detectable changes of theme within the Pauline epistles themselves, which might enable first or second century writers to mimic the Pauline writings in such a way as to produce similar scaling patterns. No such patterns appear in the letters of



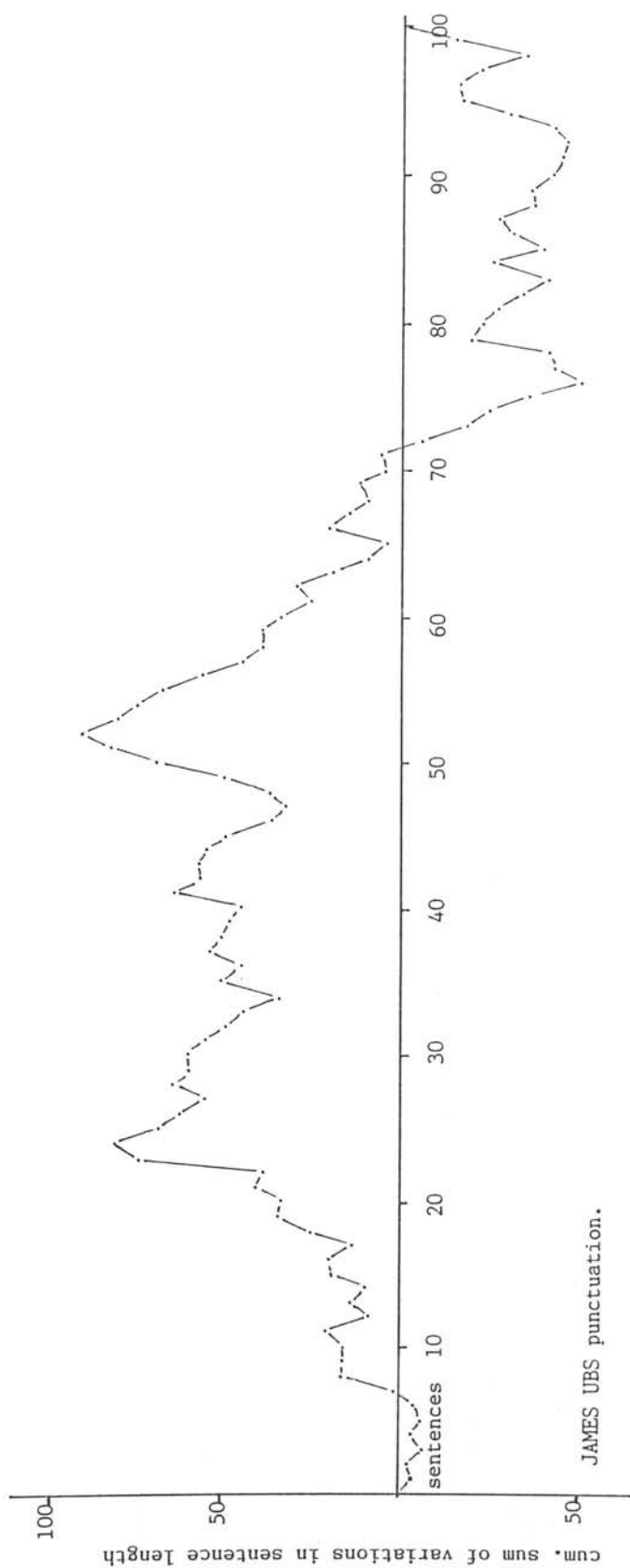
Ignatius, or in any of the catholic epistles, and it would appear that if there is such a thing as an epistolary pattern in the Paulines, it is exclusive to Paul himself. Graphs of Hebrews, 1 and 2 Peter and Jude may be referred to on pages 290, 294, 289 and 306 respectively, and graphs of James, 1,2 and 3 John and the Revelation are shown on pages 316-18.

Finally, the suggestion has been made that something similar to an epistolary form might be found in the leading articles in daily newspapers, and that this might throw light on the prime patterns of the Pauline epistles. A collage of the graphs of leading articles from seven daily newspapers published on 28th January, 1994 is shown on page 319. There are no obvious common patterns. A leader writer is as likely to begin his article with long sentences as with short. Compared with these is a collage of the sentence sequence graphs of the letters to the seven churches in Revelation 2-3. These do reflect an epistolary form, though one, the Letter to Laodicea, is seen to deviate in the middle section, and another, the Letter to Pergamum has an exceptionally long last sentence. These letters take their form firstly from the long initial sentence which begins, "To the angel of the church in...." The second sentence also has a standard beginning, "I know your works/tribulation/where you dwell...." The conclusion also has a standard form, though in some letters the last two verses come in reverse order. One sentence begins, "To him who conquers..." or "He who conquers...": the other begins, "He who has an ear...." Between these standard formulae at the beginning and the ending, a special message for each church is enclosed. It is probably a form devised by one author for a particular purpose and not an epistolary form in general use. The letters are very short - only six to eight sentences in length - and the form depends on more or less standard formulae affecting four of the sentences. This kind of construction cannot account for the prime patterns in works of up to 235 sentences in length.

### **7.1.3 The Secretary**

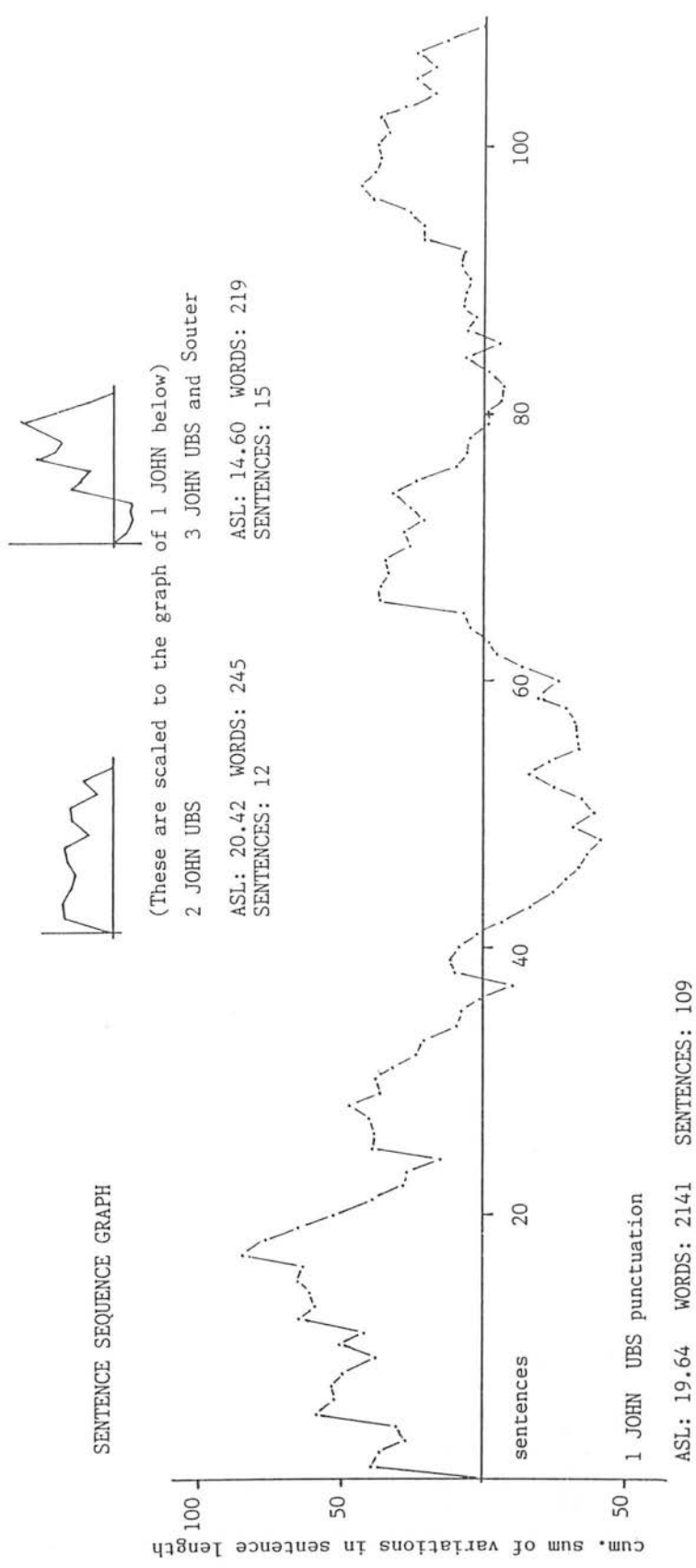
If the prime patterns do not have their origin in the work of the editor, or the researcher, and if they are not developed from first or second century epistolary forms, then the possibility of secretarial influence must be considered.

SENTENCE SEQUENCE GRAPH



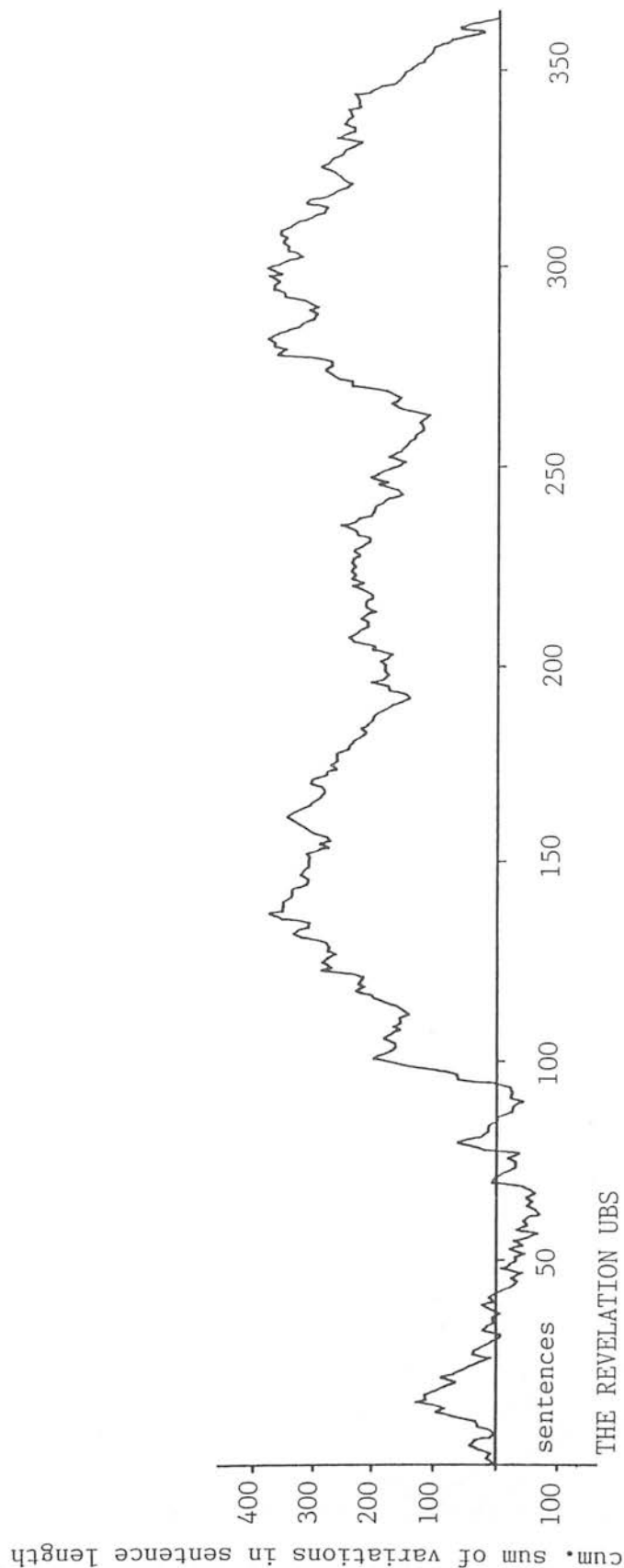
JAMES UBS punctuation.

ASL: 17.42 WORDS: 1742 SENTENCES: 100

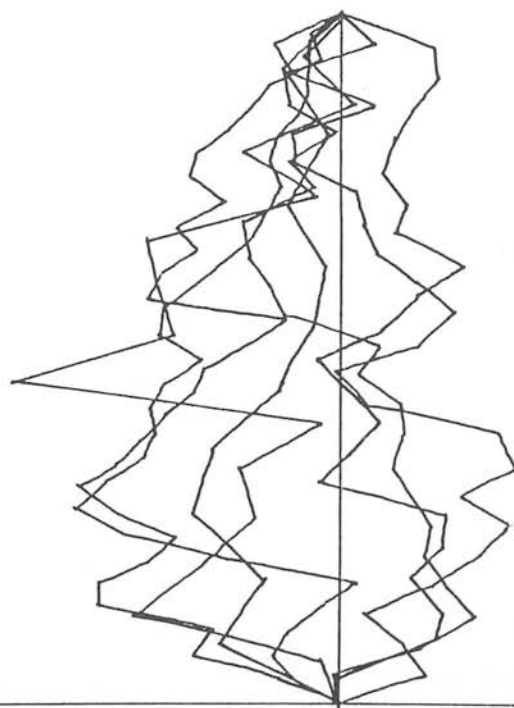




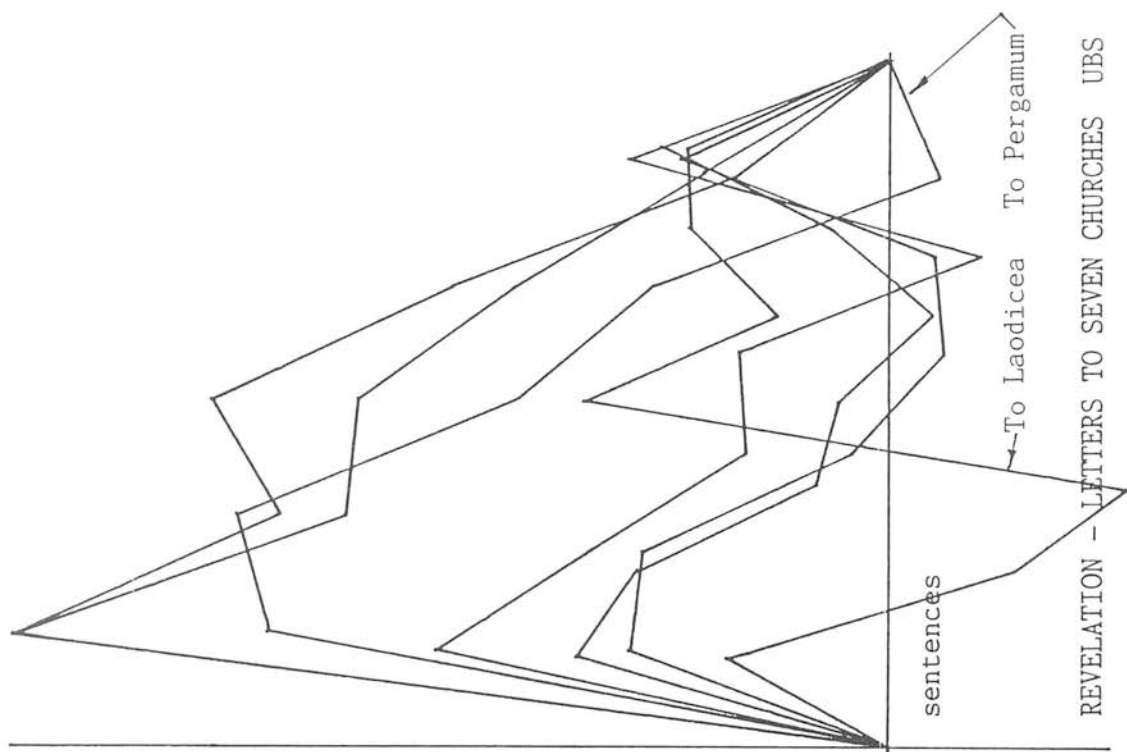
# SENTENCE SEQUENCE GRAPH



cum. sum of variations in sentence length



LEADERS FROM SEVEN NEWSPAPERS - 28/1/94



The texts provide evidence that Paul certainly used a secretary in writing Romans, 1 Corinthians, Galatians, Colossians, 2 Thessalonians and Philemon. 2 Corinthians mentions Timothy as co-sender and he may have acted as secretary at least for Chapters 1-9. The subscription at the end of Chapter 13 may be taken to suggest the use of a secretary. There is no direct evidence in Ephesians, though Tychicus is mentioned in the closing verses which may be a subscription. He may only have been the bearer of the letter. Timothy is again mentioned as co-sender in Philippians. In 2 Thessalonians, the last few verses may be a subscription, suggesting that a secretary was used for the body of the letter. The Pastoral epistles offer no direct evidence, but some scholars detect the hand of Luke in some matters of style.

Richards [55] provides a comprehensive study of the role of the secretary in Graeco-Roman times, considering the use of a secretary as a recorder, an editor, a co-author and as a composer. He discusses methods of dictation - *syllabatim* (at the speed of writing) or *viva voce* (at the speed of speaking). He raises the question of the degree of control which an author had in the production of a letter, and his responsibility for the final draft. Different letter types are identified, and the influence of traditional forms is considered. He gives evidence for the use of shorthand in antiquity. To provide the background for consideration of the Pauline epistles, Richards draws widely upon Greek literature of the period.

In considering the Pauline epistles, Richards speculates on Paul's education, his literacy, his Jewish and Hellenistic training, his method of dictation, the availability of a tachygraphist, the ability of a secretary who apparently did not correct mistakes, and the degree to which the secretary was able to influence the final text of an epistle.

The most important suggestions which may be related to the prime patterns of the Pauline epistles are found in Richards' references to the work of Gordon Bahr [55, p.176f]. Bahr's argument is that Paul used a secretary for ten of the Pauline epistles (he excludes the Pastorals), and that Paul himself added to each letter, subscriptions which were of a summary nature. This is disputed by Richards on the grounds that summary subscriptions had a legal etiology and are inappropriate in private letters. To include material which might be considered to be a summary of the contents of the letter,

Bahr tends to begin the subscriptions at an earlier point than most scholars would accept. The point of interest is that his allocation of the text between Paul and the secretary relates at several points to the prime patterns. A Table which Richards abstracted from Bahr, "*Subscriptions*", 34-40, is reproduced on page 322. The percentages have been added by Richards. The divisions suggested by Bahr may be compared with the prime patterns identified in Chapter 5.

Romans 12-15 is attributed to Paul's own hand. Bahr's thinking can be understood. The passage begins with Paul's direct appeal and ends with the benediction. In terms of prime patterns, however, it does not constitute a unit. Chapters 12-14 constitute rather less than the last quarter of the prime pattern which includes the first 14 chapters. Chapters 12-14 are therefore small scale in texture. Chapter 15 is an afterthought with an ASL which more or less matches that of the whole epistle. Chapter 16, which Bahr attributes to the hand of the secretary, consists entirely of greetings which determine its low ASL. While I do not accept Bahr's division, it does raise the question whether the form of a prime pattern can be maintained while the pen changes hands.

In 1 Corinthians, Bahr adds 16:15-20 to the subscription which is normally accepted. That is a small addition of little significance. He accepts that the secretary has written the text through the prime pattern of Chapters 1-6, and has continued through the topical section from Chapter 7 on. He detects no difference between these sections. There are considerable differences in the rhythms within these sections, but these are not related in any way to the criteria which Bahr has adopted. I would not dispute that a secretary has been used throughout 1 Corinthians, except for a short subscription.

In 2 Corinthians Bahr has attributed what is often termed "the Severe Letter" (Chapters 10-13) to the hand of Paul, and the "Letter of Reconciliation" (Chapters 1-9) to the hand of the secretary. He has recognised that there is a division between these two sections, and treats Chapters 10-13 as if they were a summary subscription to the first nine chapters: hence he attributes them to Paul's hand. This reasoning is unacceptable. The text from 10:1-12:19a or thereabouts is a prime pattern and is a separate letter with only one or two sentences of greeting missing

*A Presentation of Gordon Bahr's Analysis of the Letter Body*

*Written by the Secretary to the Postscript Written by Paul*

	Written by a Secretary	Written by Paul
Romans	1:1-11:36(&16) (78.9%) [5191(& 423) words]	12:1-15:33 (21.1%) [1500 words]
1 Corinthians	1:1-16:14 (98.2%) [1617 words]	16:15-24 (1.8%) [123 words]
2 Corinthians	1:1-9:15 (67.6%) [3033 words]	10:1-13:14 (13?) (32.4%) [1455 words]
Galatians	1:1-5:1 (75.3%) [1681 words]	5:2-6:18 (24.7%) [552 words]
Ephesians	1:1-3:21 (45%) [1091 words]	4:1-6:24 (55%) [1332 words]
Philippians	1:1-2:30 (57.1%) [932 words]	3:1-4:23 (42.9%) [699 words]
Colossians	1:1-2:7 (43.1%) [654 words]	2:8-4:18 (58.7%) [928 words]
1 Thessalonians	1:1-3:13 (58.3%) [864 words]	4:1-5:28 (41.7%) [619 words]
2 Thessalonians	1:1-2:17 (66.7%) [549 words]	3:1-18 (33.3%) [274 words]
Philemon	1-16 (69.3%) [232 words]	17-25 (30.7%) [103 words]

*Source:* This Table was abstracted from Richards, "The Secretary in the Letters of Paul", p. 177, in which abstraction from G. Bahr, "Subscriptions", 34-40 is acknowledged.

from the beginning, and with an afterthought at the end. Apart from the mention of Timothy at the beginning, there is nothing to indicate whether or not Paul used a secretary for Chapters 1-9, and no indication at all regarding 10-13.

In Galatians, Bahr brings the beginning of the subscription back from 6:11 to 5:2 in order to consider it to be a summary subscription. The prime pattern ends at 5:15 in the middle of the proposed subscription. The afterthought following the prime pattern is the passage concerning the Spirit and the Spirit's gifts. The formation of the prime pattern in Galatians is particularly clear, and again this raises the question as to whether the prime pattern can be maintained through a change in scribe.

In Ephesians and Colossians, Bahr places the division between the secretary and Paul at the markers signalling the change from the A section to the B section of the prime pattern. In other words, the secretary has written the first half and Paul the second. The markers in these two epistles indicate changes from the theological to the ethical. In Philippians, 1 and 2 Thessalonians he places the division exactly on the *λοιπόν* markers. Perhaps there is some logic in assuming that Paul took the pen in his hand to begin his subscription with the word "finally" in these cases. In Philemon, Bahr attributes verse 17 to the end, to Paul: v. 17 is the hinge point in the prime pattern.

It can be seen then that in six out of ten epistles, Bahr considers that the pen changes hands at the very point which marks the change from the large scale A section to the small scale B section. If this pattern were to be consistently found throughout the Paulines, the possibility of secretarial influence having a significant part to play in the formation of the prime patterns would have to be considered. It falls down badly, however, in Romans, 1 and 2 Corinthians and Galatians, and I have to conclude that the significance he gives to the occurrence of the word "finally" in the other epistles is misplaced. It remains an open question whether summary subscriptions would be an appropriate way for Paul to end his letters: the fact that they had their origin in legal documents does not preclude their use, but the means which Bahr adopts to find such summaries are not compatible with the rhythmic patterns which I have observed.

Richards raises the question as to how far the secretary might have acted as recorder, co-author or composer of parts or of the whole of some of the epistles, but he does not provide an answer: he simply points the way to future studies. The problems inherent in the proposal that the secretary took a major part in composing letters are similar to those involved in the proposition that the disputed epistles are the work of a School of Paulinists: this will now be considered.

#### **7.1.4 The School of Paulinists**

Previously (in Chapter 5) it has been shown that the characteristic feature of the prime pattern is a "skewed symmetry" (page 201). The primary hinge occupies a central position with a similar number of sentences on either side. The ASLs of the two batches of sentences are quite different, the first batch being, on average, longer than the second. In some letters, notably Romans, Galatians, Philippians, 2 Thessalonians and 2 Timothy, a secondary hinge corresponding to the secondary hinge in the model, is clearly seen midway between the primary hinge and the end of the prime pattern. The Table on page 325 shows the positions of the primary and secondary hinges in terms of the distance in words from the beginning of the epistle, and also in percentages of the total number of words in the prime pattern. The distance from the beginning of the epistle to the primary hinge comprises 55% - 62% of the prime pattern, except in the cases of 2 Thessalonians which is complicated by a rogue sentence 158 words long, and Titus which lies on the extreme edge of the Pauline range: in these cases the figure is 67%. The distance from the beginning to the secondary hinge, where it can be clearly identified, varies from 79%-85% of the prime pattern.

The construction of the typical sentence pattern may be visualised as follows. The epistle begins with a cyclic pattern of longer and shorter sentences, and as the epistle proceeds, the amplitude of this rhythm decreases: in other words the average sentence length diminishes. That is a simple pattern which a pseudonymous writer might emulate if he were sufficiently sensitive to the rhythm of Paul's writing. As was pointed out on page 215, this steady reduction in scale applies up to Level 3 of the model, but at Level 4 there is a significant change: at the primary hinge there is an

POSITIONS OF HINGE POINTS AND SECONDARY HINGES  
IN THE PRIME PATTERNS OF THE PAULINE EPISTLES

(Measured in words from the beginning of the epistle.)

<u>EPISTLE</u>	<u>PRIMARY</u>	<u>SECONDARY</u>	<u>TOTAL</u>	<u>MODEL</u>
ROMANS	3408 (55%)	5018 (82%)	6143	6
1 COR. 1-6	1180 (58%)		2027	5
2 COR. 10-12:19a	730 (60%)		1211	5
GALATIANS	1084 (59%)	1557 (85%)	1830	5
EPHESIANS	1209 (60%)		2019	3 - 4
PHILIPPIANS	932 (57%)	1380 (85%)	1629	5
COLOSSIANS	979 (62%)		1579	4
1 THESS.	891 (60%)		1481	1
2 THESS.	549 (67%)		823	3 - 4
1 TIMOTHY	464 (59%)		791	3 - 4
2 TIMOTHY	713 (58%)	1003 (81%)	1238	5
TITUS	358 (67%)		533	2
PHILEMON	200 (59%)		336	1

Notes: The Pastoral Epistles are adjusted as indicated in the text. The high percentage for the primary hinge in 2 Thessalonians is due to the rogue second sentence. Titus, after adjustment, is still on the fringe of the range.



**increase** in scale. From Level 5 there is also an **increase** in scale at the secondary hinges. The simple reduction in the scale of the rhythm would apply only in the cases of epistles with prime patterns corresponding to the lower levels - up to Level 3. Only 1 Thessalonians, Titus and Philemon fall within that group. Ephesians, 2 Thessalonians and 1 Timothy fall between Levels 3 and 4. The rest all correspond to Level 5 and above.

Consider what is required of a pseudonymous writer, or of a secretary given powers to act on Paul's behalf as a composer, if he is to achieve a prime pattern such as those which have been identified in these studies.

To take the simplest case first - if a pseudonymous writer were to produce Philemon or 1 Thessalonians, he would have to reduce the ASL of his writing quite abruptly to a lower level, at precisely 59%-60% of the way through the text.

To produce Ephesians, Colossians or 1 Timothy, he would have to begin with a cyclic pattern of long and short sentences, gradually reducing the amplitude, until at a point 59%-62% through the text he **increased** the scale for a section before continuing the reduction to the end of the epistle.

To produce Romans, Galatians, Philippians, or 2 Timothy, he would have to begin with a cyclic pattern, gradually reducing its amplitude, until at a point 55%-59% through the text he **increased** the scale for a section, then he would have to continue the reduction to a point 81%-85% through the text, at which point he would again have to **increase** the scale for a section, before continuing the reduction to the end of the epistle.

**It should be noted that these percentages indicating the position of scale changes, are measured in words from the beginning of the epistle. They are therefore completely independent of punctuation and do not depend upon an interpretation of the punctuation of the modern versions of the texts.**

If it is difficult to imagine how one author could achieve these patterns by making these changes consistently within 1%-4% at each hinge point, the proposition that several pseudonymous authors could independently satisfy these criteria is simply incredible. These hinge points are related to identifiable but different changes of genre in different epistles, and there is

no evidence as yet to show that any other writer had the particular rhythmic sense which has produced the Pauline prime patterns. No patterns with these characteristics have been identified in the catholic epistles, the letters of Ignatius or in any other of the 134 works scrutinised in the course of these studies. The proposals that a School of Paulinists might be responsible for the writing of the disputed epistles, or that a secretary was employed as a composer, must be dismissed.

### 7.1.5 The Single Author

Rhythm permeates the Paulines at every level. Richards [55, p. 135] says that "a skilled orator paid attention to the *numeris*, or the succession of long and short syllables, so as to give, along with varied tones of emphasis, a pleasant musical cadence." Instances of sustained *numeris* over a long period are found in 1 Corinthians 13:1-13 and 1 Thessalonians 5:14-22 [55, p. 142]. Many examples of parallelism are found, synonymous (Romans 9:2; 1 Corinthians 15:54; Colossians 3:16; 2 Thessalonians 2:8), antithetic (Romans 2:7; 4:25; 1 Corinthians 1:18; 4:10; 15:42; 2 Corinthians 6:4; 1 Timothy 3:16), and mixed (2 Timothy 2:11). Richards gives examples [55, p. 207f] of chiasmus of sense lines (Romans 10:9-10; 1 Corinthians 5:2-6; Philippians 1:15-16; 3:10; Colossians 1:13-20; 3:3-4; 3:11 and Ephesians 2:11-22).

Richards also quotes Professor Bligh's interpretation of Galatians as one large chiastic construction of major sections centred round a smaller chiasmus located at 4:1-10. This centre chiasmus falls on the secondary hinge, three quarters of the way through the epistle. The scheme envisages four sections before the central chiasmus and four following it. The section fourth from the beginning may fall on the primary hinge. The coincidence of sections of the chiastic pattern and those of the prime pattern is not surprising as both tend to be related to textual sections. The whole chiastic structure suggested, however, does not match that of the prime pattern, as the last two sections of the chiasmus fall outwith the prime pattern, in an "afterthought" section. That is not to say that they could not be included in a chiastic layout that was in the author's mind. This example is so skewed that Richards is probably correct in his assessment that the proposal reflects Professor Bligh's creativity more than that of Paul.

It is doubtful whether these rhythmic constructions are responsible for the overall sentence structure of whole epistles but all these rhythmic units contribute to the structure. The cyclic nature of the opening portions of several epistles has long been noted, and the significance of the mathematical Model is that it picks up this feature and relates it to the main contrast in scale between the first and latter parts of each epistle. In so doing, it reveals the intermediate rhythms which are echoed in the graphs of the actual sentence sequences at many points. The sentence sequences do not follow the model in a slavish fashion: they display human variations at many points, but these variations average out and the main rhythmic structure is seen to be maintained.

This rhythmic structure absorbs many kinds of minor rhythms. It absorbs preformed material - παραδόσεις (traditional material which Paul wishes to hand on) and also material which Paul had himself thought through, and either committed to memory, or recorded in μεμβράναι (parchment notebooks - possibly the "parchments" of 2 Timothy 4:13). Some of the sequence graphs give evidence of this. The passage on resurrection in 1 Corinthians 15:1-34 is clearly a subject which Paul had previously thought through, and it produces a tiny, individual, classic Pauline prime pattern, set amongst the sundry patterns of the other topics taken up in that letter from Chapter 7 to the end. Some of these minor rhythms arise from traditional material already set in rhythmic form: others arise from Paul's own rhythmic sense.

The rhythmic nature of the construction also takes precedence over syntactical and grammatical considerations. Richards quotes Nigel Turner [55, p. 143] - "Paul allows himself to be drawn along on the wings of his thoughts in sharp bursts, resulting in parentheses and discords, while particles and participles are brought in to weave over the gaps in diction." Unpolished phrases, occurrences of zeugma, anacoloutha and solecisms are numerous, and uncorrected. James Moffatt, in comparing the styles of the Pauline epistles and Hebrews, refers to Paul's "rugged, broken style" [45, p. 434]. This does not do justice to the strong discipline which runs through the sentence structure of the epistles. Moffatt gets nearer the truth when he refers to the "rhythmical flow (of Galatians) which recalls in several places the methods of contemporary rhetorical prose". He adds [45, p. 89] that "in this respect it agrees with 1 Thessalonians, 1 Corinthians, Romans 3:19f.,

11:28-33 etc. and Philippians, all of which are more or less marked by rhythmical features." The apparent solecisms and the apparent "rugged, broken style" are due to the fact that precedence is given to the rhythm of the text, above all syntactical and grammatical considerations.

Richards raises the question as to why these crudities remained uncorrected, and suggests that Paul's secretary was no better educated than Paul himself [55, p. 153]. It must be appreciated that Paul's intention was very different from that of other writers like Cicero, who indulged in letter writing for the sake of aesthetic satisfaction, and who carefully proof read the script, taking time to polish it. Paul wrote to congregations, mostly consisting of unlearned people, and his purpose was to convey a message, usually with a sense of urgency. The form of the prime patterns, with their thoroughly integrated contrasts, strongly suggests that Paul dictated his epistles *viva voce*, and that his secretaries had tachygraphic skills. Material dictated *syllabatim*, or spontaneously without prior thought, would be less likely to produce the contrasts and the tightly integrated structure of the prime patterns: such material would be more likely to produce the small individual patterns which are found in 1 Corinthians 7-16 and 2 Corinthians 1-9. It is doubtful whether his epistles were proof read at all, which is surprising if his secretaries were skilled in tachygraphy, and the truth may be that Paul was not the kind of person to take kindly to suggestions by his secretary that his script might be tidied up.

The reference to "large letters" in Galatians 6:11 remains problematical. Deissmann's explanation that "the apostles 'large letters' are best explained as the clumsy, awkward writing of a workman's hand deformed by toil..." [55, p. 174] is the supposition of an academic who does not realise that tailors, sailmakers and tentmakers are extremely nimble fingered. Difficulty with eyesight, possibly related to the thorn in the flesh, might account for "large letters", but might also hinder his tent making. It may have been simply a device for drawing attention, as italics might be used today.

The prime patterns point to material well prepared, stored up in the mind, and poured out at speed, with sundry afterthoughts added to the prepared material. In this process, the pace was maintained, the rhythm sustained to produce the most extraordinary, intricate, and balanced scaling

structures in which rhythm took precedence over all considerations of syntax and grammar. The conclusion that the Pauline prime pattern, and possibly much of the afterthought material, come from the mind of one author, is not in accordance with some commonly held views. Nevertheless, that is the direction in which the evidence is pointing.

## **7.2 The Origin of the Prime Pattern - 2**

### **In Hebrews, 1 and 2 Peter**

The similarity in the sentence structure of these epistles was noted in Chapter 6. The prime patterns were identified as follows: 1 Peter - 2:1 - 5:11; 2 Peter - 1:1 - 3:13; Hebrews - 1:1 - 13:25. The adjustments to punctuation were minimal, amounting to the substitution of five colons in the place of full stops or interrogation marks in 1 Peter, and four colons for full stops in Hebrews. The UBS text was followed generally, and wherever a colon was used in place of a full stop, Souter was followed except at Hebrews 10:31 where a small sentence was linked with quotations.

If I had been presented with these data without any indication of their origin, and asked to make a judgement regarding authorship on the basis of scale patterns alone, I would have to compare them with data derived from the rest of the study material amounting to over 400,000 words. In the scrutiny of that material several sets of comparable extended motifs have been found, in the Paulines, in Ignatius, in my own work and on a smaller scale in James S. Stewart. In every case, where similar motifs have been extended over such lengths of text, there is good reason to believe that only one author has been involved. No case has been found of such similarity in sentence sequences over such extended lengths, between works of different authors. I would have to take into consideration the possibility of common authorship.

In the light of mainstream scholarship, this is an unexpected finding, yet it must be taken seriously. At the same time it must be appreciated that this is probably the first ever exploration of scale in literature, and the scope of the test material is limited. While future research will undoubtedly provide a deeper understanding of the effects of scale, a present judgement



can only be made in terms of the material embraced in this study.

Minimal adjustment to punctuation was required to identify the common features shared by these epistles, but the study of the Paulines in section 7.1.4. (page 324) provides a way of making a comparison **independent of punctuation**. The prime patterns of these three epistles are quite different from those found in the Pauline epistles. They do not rely on the intricate structure of balanced contrasts which produce the characteristic skewed symmetry. They commence with a section of more or less average sentence length. This is followed by a section conceived on a larger scale which contains the kernel of the epistle's message. This in turn is followed by a smaller scale closing section. The positions of these scale changes may be measured, and the results are shown in the Table on page 332.

The first major change of scale in each case falls between 41.9% and 44.5% of the way through the prime pattern. The second change of scale occurs between 65.1% and 69.3% of the way through the prime pattern. If 1 and 2 Peter have different authors, living in different centuries, as many scholars would hold, and if Hebrews is the work of another independent author, it is a truly remarkable coincidence that in each epistle the major changes of scale should occur consistently at positions which are separated by no more than 2.6%-4.2% of the text. These changes are directly related to the text in that the large scale central sections contain the kernel of the message, and they begin and end at points of textual significance. But the subject matter is quite different, with different themes.

The theme in 1 Peter 3:8-4:6 concerns Christians being "Partakers in the Sufferings of Christ", beginning "Finally (τὸ δὲ τέλος)...have unity of spirit, sympathy, love of the brethren, a tender heart and a humble mind."

The theme in 2 Peter 2:4-2:16 is the Judgement of God, beginning "For if God did not spare the angels when they sinned, but cast them into hell and committed them to pits of nether gloom to be kept until the judgement....".

The theme of Hebrews 8:1-10:25 is the Priesthood of Christ, beginning, "We have such a high priest, one who is seated at the right hand of the throne of the Majesty in heaven...."

# POSITIONS OF SCALE CHANGES IN PRIME PATTERNS OF HEBREWS, 1 AND 2 PETER

(Measured in words from the beginning of the epistle.)

<u>EPISTLE</u>	<u>FIRST CHANGE</u>	<u>SECOND CHANGE</u>	<u>CENTRAL SECTION</u>	<u>PRIME PATTERN</u>	<u>TOTAL</u>
1 PETER	515 (41.9%)	853 (69.3%)	3:8 - 4:6	2:1 - 5:11	1230
2 PETER	443 (44.5%)	648 (65.1%)	2:4 - 2:16	1:1 - 3:13	995
HEBREWS	2132 (43.0%)	3269 (66.0%)	8:1 - 10:25	1:1 - 13:25	4953

The scale patterns are therefore directly related to the content, but the content is quite different in each case. This means that a search must be made for a cause of this consistency. It cannot be found in the quality of the Greek linguistic style, for that varies from "among the best in the New Testament" in the case of Hebrews [Kümmel 36, p. 395], to "cultivated Greek which employs many rhetorical devices" in the case of 1 Peter [Kümmel 36, p. 423], and "cumbrous and obscure" in the case of 2 Peter [Moffatt 45, p. 364]. It cannot be found in a common genre; or through the letters addressing a common problem, or having the same destination; or through a common epistolary form being adopted. The evidence of the patterns found in the material included in this study, points to common authorship.

This would have very far reaching implications, and again it must be said that the purpose of this dissertation is to investigate scale in literature, and not to rewrite the Introduction to the New Testament. While few scholars have shown confidence in identifying the author of Hebrews, many have shown supreme confidence in affirming or denying the Petrine authorship of 1 and 2 Peter. Those denying Petrine authorship are probably in the majority, though scholars like Donald Guthrie give very fair consideration to both positions [29].

The Biblical evidence requires to be re-examined. If 2 Peter 5:12 is to be taken seriously, and Silvanus, or Silas, is to be accepted as Peter's secretary responsible for penning the letter, then the mode of dictation must have been different from Paul's. It would be necessary to think of Peter giving Silas the gist of what he wished to say, and leaving Silas some freedom to phrase the message in his own way. Some of the thought and possibly some of the vocabulary would be Peter's, but the sentence pattern would be Silas's. If Silas were also the secretary who penned 2 Peter, in the same way the thought and vocabulary might be Peter's, but addressed to a very different situation, while the sentence pattern would again be that of Silas. It follows that Hebrews would therefore be Silas's own work and his own thinking - the Gospel according to Silas.

It might go some way towards explaining the differences in the quality of the Greek, if it were appreciated how an author in modern times can embrace a wide range of styles and vocabulary, changing with different



circumstances. In my own experience, I have written a theological essay in careful English which ended in a poem, as that seemed to be the appropriate way to finish the work. In contrast, I have written hundreds of technical reports giving advice to statutory bodies: these were written in a very different style with different vocabulary. I have also written letters to defaulting contractors who had failed to fulfil their promises - letters which in my unregenerate days descended to the level of invective. These three classes of writing, all employing different styles and vocabulary, all with different purposes and destinations, may be compared with the excellent Greek of Hebrews, the sound Greek of 1 Peter, and the crude Greek of 2 Peter.

The other main point of contention regarding the dating of these epistles is that of the relation of 2 Peter to the heretical systems of the second century. Here scholars differ. When material contains references which might conceivably be linked with a particular heresy, some scholars are perhaps too ready to date it according to the period when that heresy blossomed into full flower. Heresies have their roots in the failures of human nature, and in the wrongful exaggeration of some aspect of a great truth. The gnostic systems of the second century had their roots in small but troublesome developments in the first century, and it may be fairly assumed that Paul and his contemporaries were sensitive regarding the development of such dangerous trends.

If there is any truth in these speculations, then they open up an intriguing possibility, that no fewer than sixteen New Testament epistles come from the hands of Paul and his travelling companion, Silas. This points to a close group of leaders who argued out the faith in discussion, and whose different views are reflected in their writings. If James and Jude were members of that circle, it might explain certain correspondences and certain differences between their epistles and those of other leaders.

These, however, remain speculations meantime, until the effects of scale have been further explored and a wider base established upon which to found judgements. The present evidence, however, demands exploration in this direction.

# CHAPTER 8

## Conclusions

Before formulating conclusions, brief reference is made to some of the more important aspects of scale revealed in these studies.

In the Introduction, scale was explored in cosmic terms, in human terms, and in terms of the arts. It was asserted that all creative activity has its locus within a scale spectrum, and that while this may be less obvious in literature than it is in the visual arts, every author writes within a particular scale range, the characteristics of which may be revealed by graphical methods. Human perception of scale is to be distinguished from the physical dimensions by which scale is measured. Scale is related not only to human needs in the physical sense, it is related to human aspirations and to the sense of the Holy (in religion) and the sublime (in art). These can affect the scale of creative work, resulting in monumentality in architecture and variations in the syntactical structure of literature. These variations are measurable, but are unpredictable.

Test material included eighty works by six modern authors and three Greek authors, in addition to the New Testament epistles, and amounted to 423,312 words. Graphical analysis revealed that authors were capable of producing works with different average sentence lengths, but with sentence length distributions in precise proportion. These display scale differences and constitute a first proof of the existence of scale in literature. It was then found that similar scale differences could be detected in the way sentences were extended by the use of colons and semicolons. By mapping the ranges

covered by each author in terms of the shape of sentence distributions and in terms of the average sentence lengths of their works, areas of overlap and areas of discrimination between authors were identified. The study of sentence sequence patterns revealed that an author could produce similar sequences of different sizes which were also in proportion. These too display scale differences.

By carefully relating sequence patterns to the content of the text, it was demonstrated that considerable changes of scale occur within works, usually associated with changes in genre or subject matter. Indeed, such internal changes of scale in the Pauline epistles were reflected in sentence length, and produced greater differences than were found between epistles. This raised serious questions regarding the matter of statistical homogeneity. If the Pauline corpus could not be regarded as homogeneous with regard to sentence length, then neither could each epistle. This implied that sections of the texts written at different scale levels required at least two authors for each epistle, sharing the writing in precise and consistent proportions.

A study of Morton's modified full stop sentences showed how patterns inherent in the sentence structure were weakened when modified sentences were used in constructing graphs. The scale of the text was not truly reflected. Block sampling, where blocks crossed the boundaries of sections written at different scale levels, also provided data from which certain kinds of inferences could not be validly drawn. The failure to recognise scale differences in following these procedures may mean that the criteria presently used to establish statistical homogeneity cannot be taken as a sure guide in matters of literary homogeneity and authorship.

The identification of "prime patterns" in a group of the Pauline epistles which required little adjustment of the punctuation, allowed further identification of primary material where it was linked with or embedded in secondary material. This threw light on the way the material had been dictated. The prime patterns showed such consistency of form that it was possible to construct a mathematical model based on features observed in the epistle to Ephesians. This model could be displayed showing different levels of detail, and it was surprising to find that the model based on Ephesians produced, at a different level, a credible schematic for Romans. The characteristic changes of scale within the epistles were consistently marked

by changes in genre or by the term τὸ λοιπὸν or its equivalent, and produced the "skewed symmetry" found in all the Pauline epistles. Even the Pastoral epistles exhibited this feature when suspect material was removed and one displacement of text rectified. This allowed the Pauline texts to be classified in a new way, as primary, secondary or Corinthian pastoral material.

The discovery of corresponding sequence patterns in Hebrews and substantial portions of 1 and 2 Peter was unexpected. In demonstrating the correspondence between the three epistles, the adjustments to the UBS text involved only the substitution of a total of five colons for question marks or full stops in 1 Peter, and four colons for full stops in Hebrews. Wherever a colon was used instead of a full stop, Souter was followed, except at Hebrews 10:31 where a small sentence was linked with quotations.

The analysis of the positions of scale changes in that group and also in the Pauline epistles, showed that such changes occur within very narrow limits. Irrespective of the length of the epistle, the scale changes in the Pauline epistles occur within 1% of the way through the text in the simplest cases, and within 4% in the more complex cases where there are two major changes involved. In the Hebrews/1 and 2 Peter group, the changes occur within a 2.6%-4.2% slot where there are two major changes in each epistle. Measuring the positions of scale changes in this way eliminates punctuation problems. The likelihood of different authors meeting such demanding criteria fortuitously is remote.

This study is only a first step in examining the effects of scale in literature, and clearly there are many areas requiring further exploration. There are also areas of study which have already been covered using the traditional linguistic and literary approaches, and also some using statistical analysis, which might be re-examined to determine whether the presence of undetected scaling effects might require conclusions to be reconsidered.

In the field of statistical stylometry, the scale factor must be taken into account. Sentence definition and block sampling must be reconsidered. Some of the features selected by Kenny, and possibly some of Ledger's, reflect sentence length and are therefore scale-related. A check is necessary to determine whether the same problem affects other recent univariate and multivariate studies. The recognition that the sense of the numinous may

have a direct effect on sentence length raises a profound question regarding the limits of statistical science with regard to the analysis of literature. Statistical science is based on the observation of chance and does not recognise the Holy. A *behavioural* science is required to appreciate the effects of scale.

The question of homogeneity (page 336) requires clarification. Kenny points to varying standards applied by Morton who drew conclusions concerning literary homogeneity from evidence of statistical homogeneity. When Morton allocated the Pauline epistles to the hands of several different unknown authors, it is likely that in his failure to recognise the effects of scale, he did no more than place the epistles in different scale bands.

Statisticians have not found sentence length to be a useful indicator, principally because the scale element has not been recognised. However, sentence length reflects the creativity of an author in a most direct way, and may serve a very useful function when the relationship between sentence length and scale is recognised. Likewise, Hilton and Holmes show the shortcomings of cumulative sum charts in the methods used by Morton and Michaelson in determining authorship, and they present a more sophisticated method based on weighted cumulative sums. That method performs only marginally better. However, while cumulative sum charts may fail to give dependable results used in that particular way within that discipline, they have proved to be very useful in demonstrating scale relationships.

Graphical evidence must be closely related to the content and genre of texts. Statistical studies have often failed in this respect. Kenny's study of the New Testament epistles examines the percentage rate of occurrence of features in the text, irrespective of content and genre. Neumann, at one stage, limits his study material to that of "four Christian authors", but such a slight consideration of genre is inadequate. Nevertheless, in these substantial statistical studies which examine hundreds of features, there must be immense potential which may be realised when the effects of scale are identified.

This decade has made the computer available to most students, and opened up areas which in the past were denied by reason of the prodigious amount of time and labour required to study them. My student researches in

the 1960's involved the preparation by hand of cumulative sum graphs of all the New Testament letters, the calculations being assisted by nothing more than a pocket calculator. In these present studies, the use of a personal computer has enabled me to cover ground much more speedily. However, personal computers of the kind I have used are already inadequate. Most of the graphs in these present studies have also been prepared by hand, simply because an architect's drawing board has a far greater capacity than a monitor with a super CVGA screen. Such a screen cannot cope with a cumulative sum graph of Romans. The graphics programme must be able to provide complete control over scales, and not accommodate them to the screen as the simpler programmes do. This requires a CAD machine with a capacity of about ten times times that of a PC.

There is scope for new work in linguistics as the presence of scale in literature is acknowledged. The building blocks of language are assembled into different constructions depending on the scale levels inherent in the text. These levels are influenced by many factors and it is the task of the linguist to investigate these.

The influence of the secretary in the writing of the New Testament epistles needs further study. I have concluded that it is likely that the prime patterns truly reflect the inherent structure of the material prepared in the author's mind, and which may be committed to paper by his own hand or by means of dictation. The evidence of the Pauline epistles and of the Hebrews/ 1 and 2 Peter group suggests that within the circle of early church leaders, secretaries were employed both as recorders and composers. The identification of prime patterns offers a new line of research.

Kenny passes the responsibility for determining matters of authenticity on to the Bible scholar, although he is not one himself. That presupposes that the Bible scholar has a broad enough base on which to found his judgements. Here a multi-disciplinary approach is essential. Much Biblical scholarship is incestuous, and consists of the assessment of the work of other Biblical scholars, rather than attempting to find new, hard evidence. Historically it can be seen that this tends to produce schools of thought in which scholars select an authority to follow. Once established, it may take a long time to shake free from an assumed authority and return to hard evidence. New methods must be encouraged and adopted to supplement the



traditional.

The evidence of scaling patterns throughout the Pauline epistles requires that further consideration be given to the versatility of Paul. Kenny saw Paul as a very versatile author, yet as far as sentence length is concerned, his range is no wider than that of Isocrates. There is danger in defining an author by samples of his work drawn from one particular stage in his development, and denying to him any works that show different characteristics. There is no doubt that Paul was a creative writer. He had a creative mind and developed new vocabulary, taking common words like πίστις, κόσμος, ἀγάπη and σάρξ and giving them new depths of meaning. Allowance must be made for the development of vocabulary through debate with his opponents, as he came to grips with their terminology, and as he met the challenging thinking of his time. On occasion he quotes from Greek authors. Paul possibly spent ten years in Tarsus, Cilicia and Antioch, and it would not be surprising to find that he was familiar with Hellenistic thought and terminology. He must be attributed with some sensitivity regarding the small dangers of human thought and behaviour, which if left unchecked, might grow into heresy, such as the Gnostic heresies of the second century. The troubles in the Pastorals, for example, may have their origin in Jewish-Christian-Gnostic false teaching, as Kümmel indicates [36, p. 379], rather than in second century Gnosticism.

Through all the Pauline epistles there runs an extraordinary sense of rhythm which dominates the writing. It may not always be apparent to the ear, but it is sustained in an intricate network, in which rhythms at different scale levels are woven together into an integrated whole. Nowhere else in the study material have such scale systems been found, and these patterns may be characteristic of Paul.

My conclusions, as I indicated in the Preface, now take the form of modifications to the working hypothesis which has served me through my ministry. The identification of the prime patterns has pinpointed the consistency which I had previously detected in the corpus. I take these prime patterns to be related to material which Paul prepared in his mind prior to dictating an epistle. A clear prime pattern is to be found in each of

the thirteen epistles. Their location tends to support well known views about the construction of several of the epistles, and also sheds new light.

The prime pattern in Romans covers the first fourteen chapters. Chapter 15 has the characteristics of an afterthought pattern, rather than that of a separate work. Chapter 16 consists almost entirely of greetings.

In 1 Corinthians, the prime pattern covers the first six chapters, confirming that 7:1 gives a true impression that Paul is then turning to deal with individual topics raised by the Corinthian congregation.

2 Corinthians has an unsatisfactory beginning, in that it does not have a typically strong Pauline structure, but is like 1 Corinthians 7-16, dealing with individual topics one after another in a series of small patterns. It is clear that the text from 10:1 to 12:19a constitutes another almost complete letter, with an afterthought up to 13:13. Only one or two sentences of greeting are missing from the beginning: when allowance is made for that, the graph provides the expected skewed symmetry. The small passage from 6:14 to 7:1 I take to be a fragment of another letter.

Galatians and Ephesians provide substantial prime patterns and short afterthoughts. Philippians, Colossians, 1 and 2 Thessalonians and Philemon all comprise complete prime patterns.

In comparing Ephesians and Colossians, I had previously considered that Ephesians was a development of Colossians. However, the location of the advice to husbands, wives etc. suggests strongly that the prime material of Ephesians ended on a high note with the vision of the relationship of marriage in terms of that of Christ and the Church. The further advice is afterthought material. This suggests that Ephesians is the prior epistle, and that in writing Colossians, material has been recast, the vision of Christ and the Church dropped, and all the advice to various parties included in the prime material. The prime patterns of the two epistles are very similar, pointing to the same author. But whichever work was the second to be written, the material has been entirely recast: it cannot be a modification of the first epistle by another hand.

1 and 2 Thessalonians are the most problematical, 1 Thessalonians



because it lacks contrasts at intermediate level, 2 Thessalonians because it has enormous contrast caused mainly by the very long second sentence. In both cases the main division providing skewed symmetry is clear. The cause of the difficulty in 2 Thessalonians probably lies in the nature of the content. The very long sentence, which is concerned with the Day, may be compared with the long sentences in James S. Stewart's sermons - sentences full of numinous content.

The graphs of 1 and 2 Timothy are not at all similar until the "bishops" passage is removed from 1 Timothy, and in 2 Timothy the passage referring to Phygelus, Hermogenes and Onesiphorus, and containing some exhortation to Timothy, is relocated in its proper place near the end of the epistle. The graphs then correspond and recover their typical skewed symmetry.

I find no reason to regard the secondary material as non-Pauline, except the passages in 1 Timothy and Titus regarding church leaders and Cretans. The passages concerning church leaders I would take to be marginal notes penned by some bishop in circulating copies of the epistles to his congregations, and later incorporated into the text.

The Hebrews/ 1 and 2 Peter group provide an unexpected correspondence, although I detected similarity in their textures many years ago. If the correspondence is fortuitous, it is an astonishing coincidence. The only comparable correspondences in the test material occur in works sharing the same author. Nevertheless, I am aware that this is still an early stage in the study of scale in literature and I would make no rash claims. The correspondence points towards common authorship, and if that is the case, the Biblical evidence must be regarded and Silvanus must be considered as a likely candidate, acting as secretary and composer for Peter, and writing Hebrews as his own composition.

These modifications to my working hypothesis do not introduce any startling new theory regarding the Pauline epistles: rather, they support views already familiar. The matter of Hebrews and the Petrine letters is more controversial: I have indicated the direction in which the evidence points but I hold the matter for further consideration. I make only one claim - to have demonstrated the existence of scale in literature, which opens up a new area of enquiry which may, or may not, be accessible by means of statistical

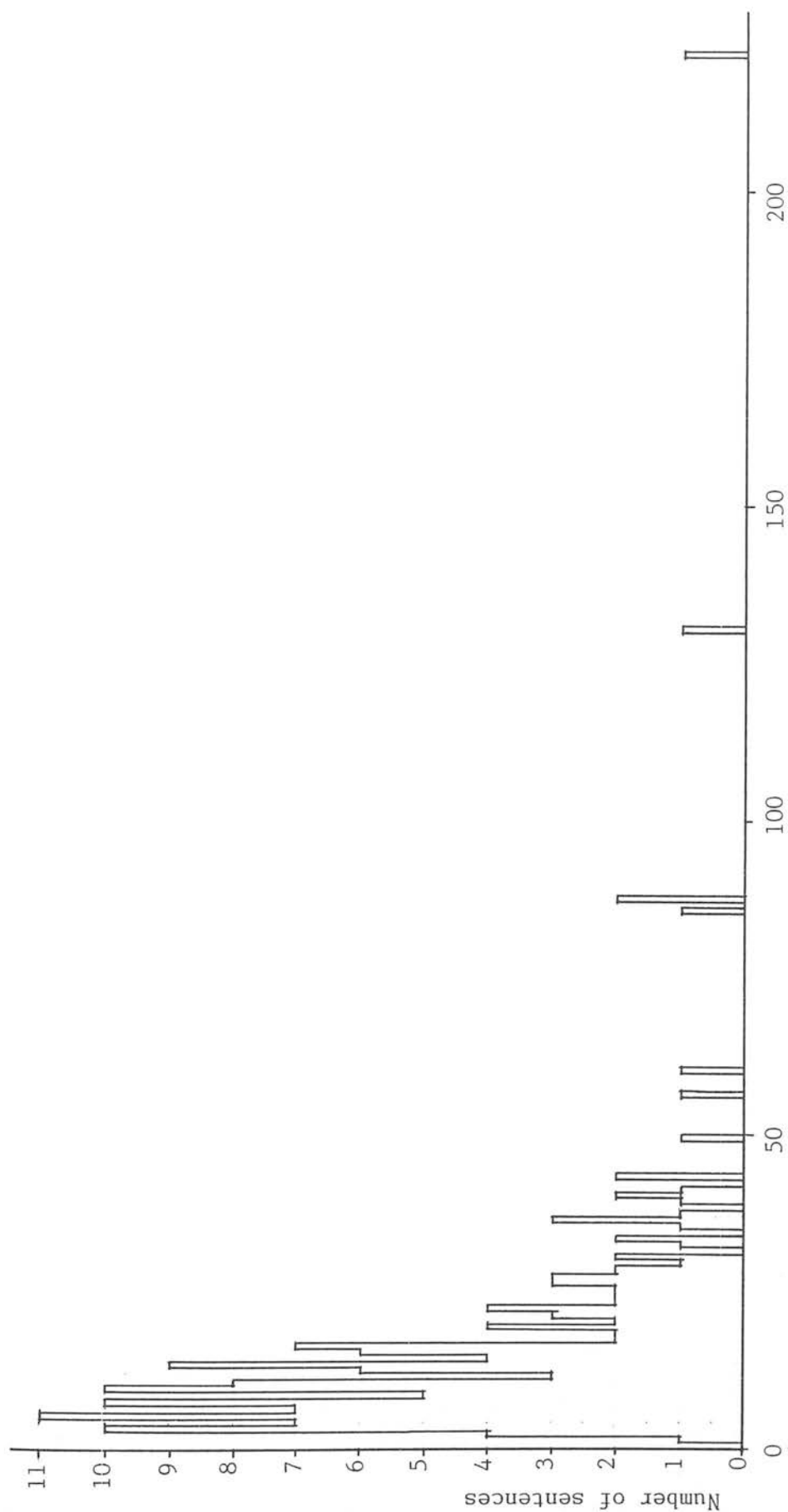
methods, for scale reflects human moods and feelings, rational and irrational. Scale reflects human creativity, and true creativity is quite unpredictable, resulting in something which has never existed before. Scale reflects Man's wonder at Creation, and his wonder at the very presence of the Creator.

## Appendix A

### The Sentence Distribution Curve

Many attempts have been made to find an equation which will generate the asymmetrical sentence distribution curve. C.B. Williams [60, p. 69] refers to Udney Yule's work in 1939 in which by comparing the frequency distribution of sentence length in works of different authors, he claimed to be able to produce evidence concerning authorship. He quotes Yule as saying of the skew distribution that "they are not of the Poisson type, but of the type in which the square of the standard deviation largely exceeds the mean." K.R. Buch [20] suggests using the logarithm of the sentence length as a random variable. Sichel [57] has produced a formula which fits a range of distributions quite well, but it suffers from the weakness of all such attempts, in that it cannot determine whether a borderline case does not fit because the sample comes from a different hand, or because the formula is not capable of universal application.

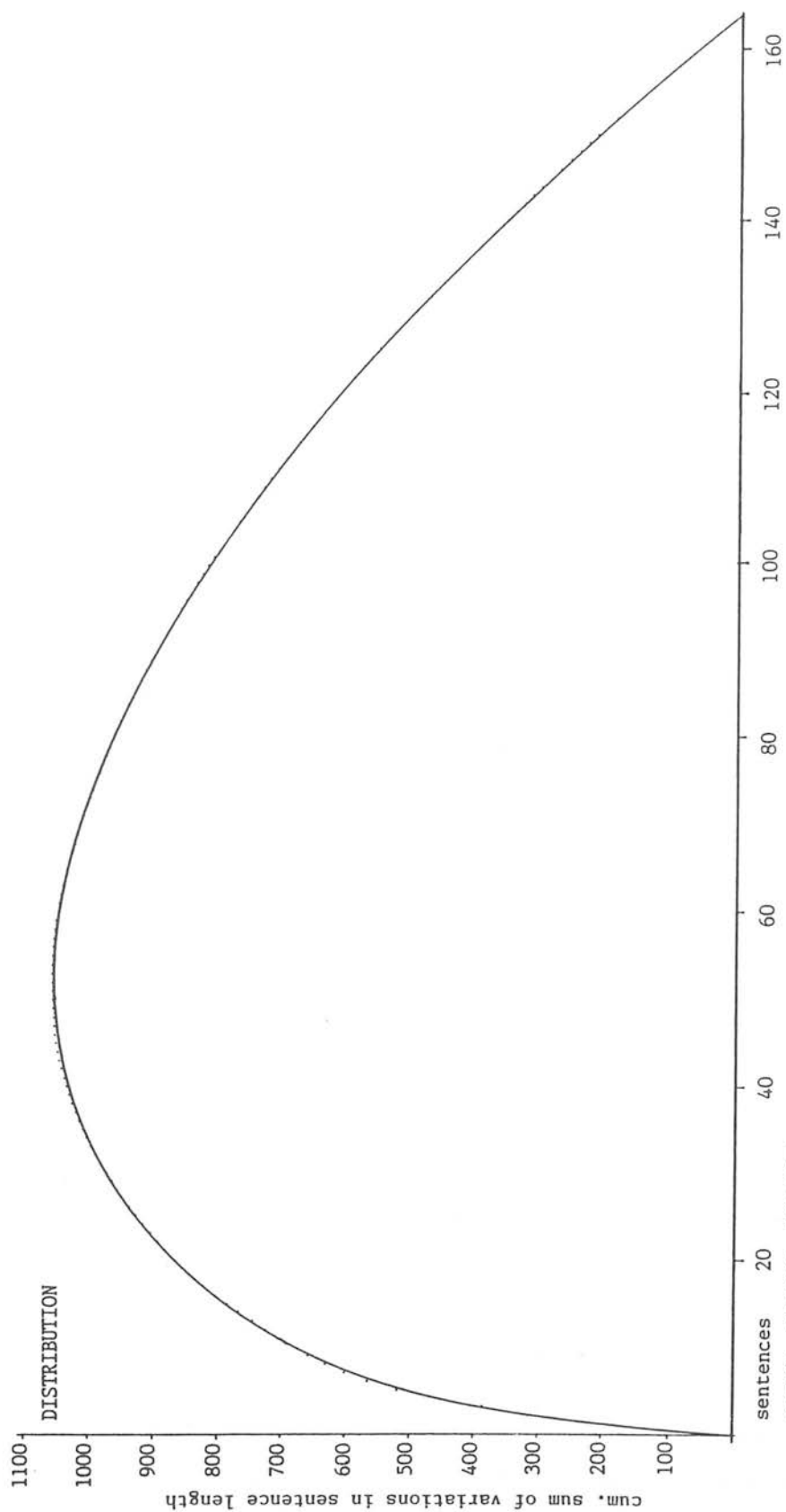
An example of this type of graph is given on page 345. It shows the sentence length distribution of one of James S. Stewart's sermons and illustrates the problem involved in attempting to find a mathematical equation for material involving discontinuous variates. Particular lengths of sentence are unrepresented, and very long rogue sentences appear. Underneath this discrete material lies a strong structure, but to see it clearly the curve has to be converted to another form which is shown on page 346. This is a cumulative sum graph of variations from average sentence length, with the sentences sorted in order from longest to shortest. It solves the problem of gaps in the representation of sentence lengths, and while steps at



Number of words in sentence

JAMES S. STEWART - "O MAN, GREATLY BELOVED"

SENTENCE DISTRIBUTION FOR COMPARISON WITH NORMAL BELL-SHAPED CURVE



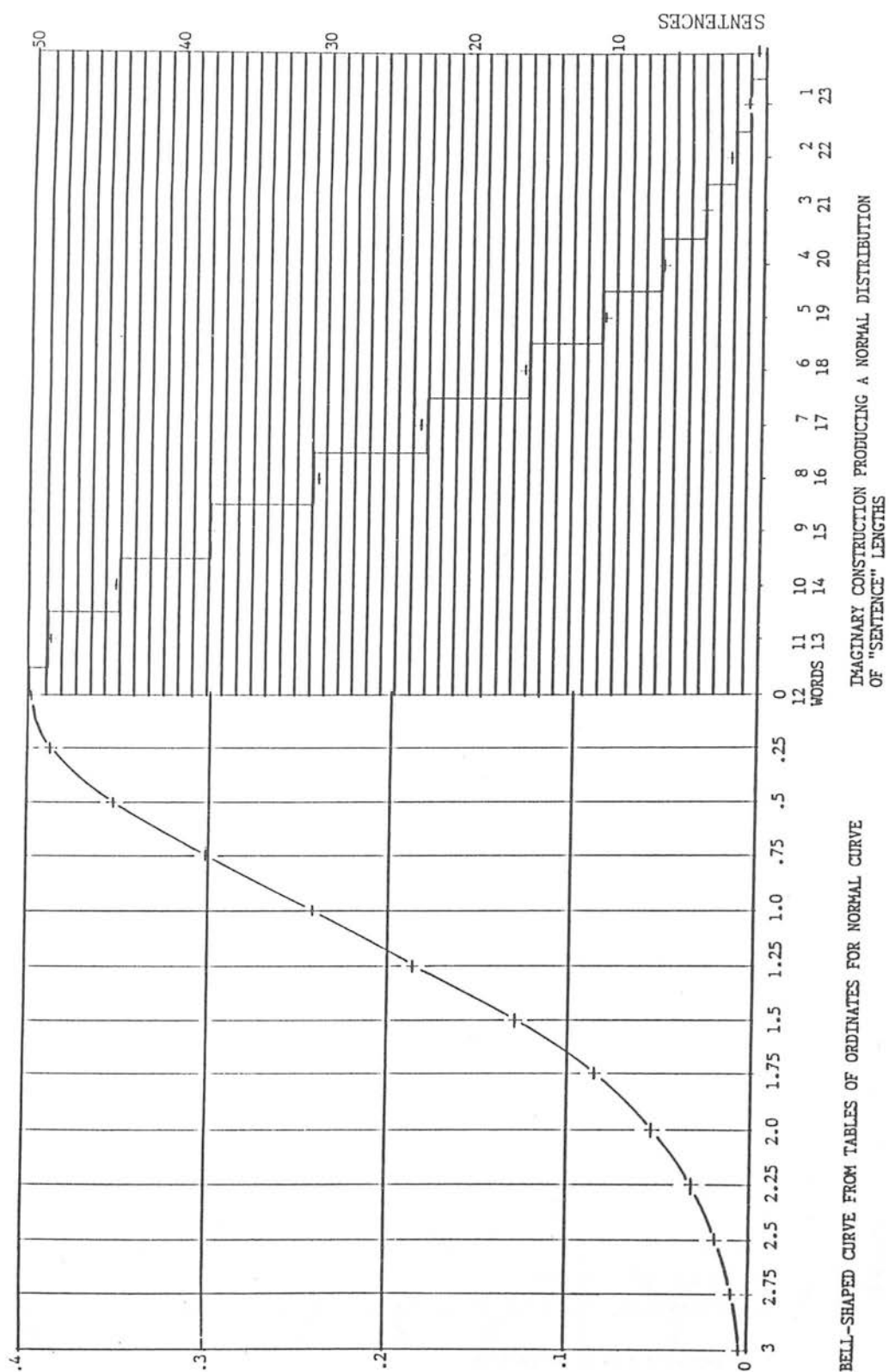
AUTHOR: JAMES S. STEWART  
TITLE: "O MAN, GREATLY BELOVED"  
A.S.L. 19.34 WORDS: 3172 SENTENCES: 164

each change in sentence length still occur, they now appear as minor facets through which a smooth curve can be drawn. Occasional variations are by this method reduced to a minimum, and the underlying construction is displayed.

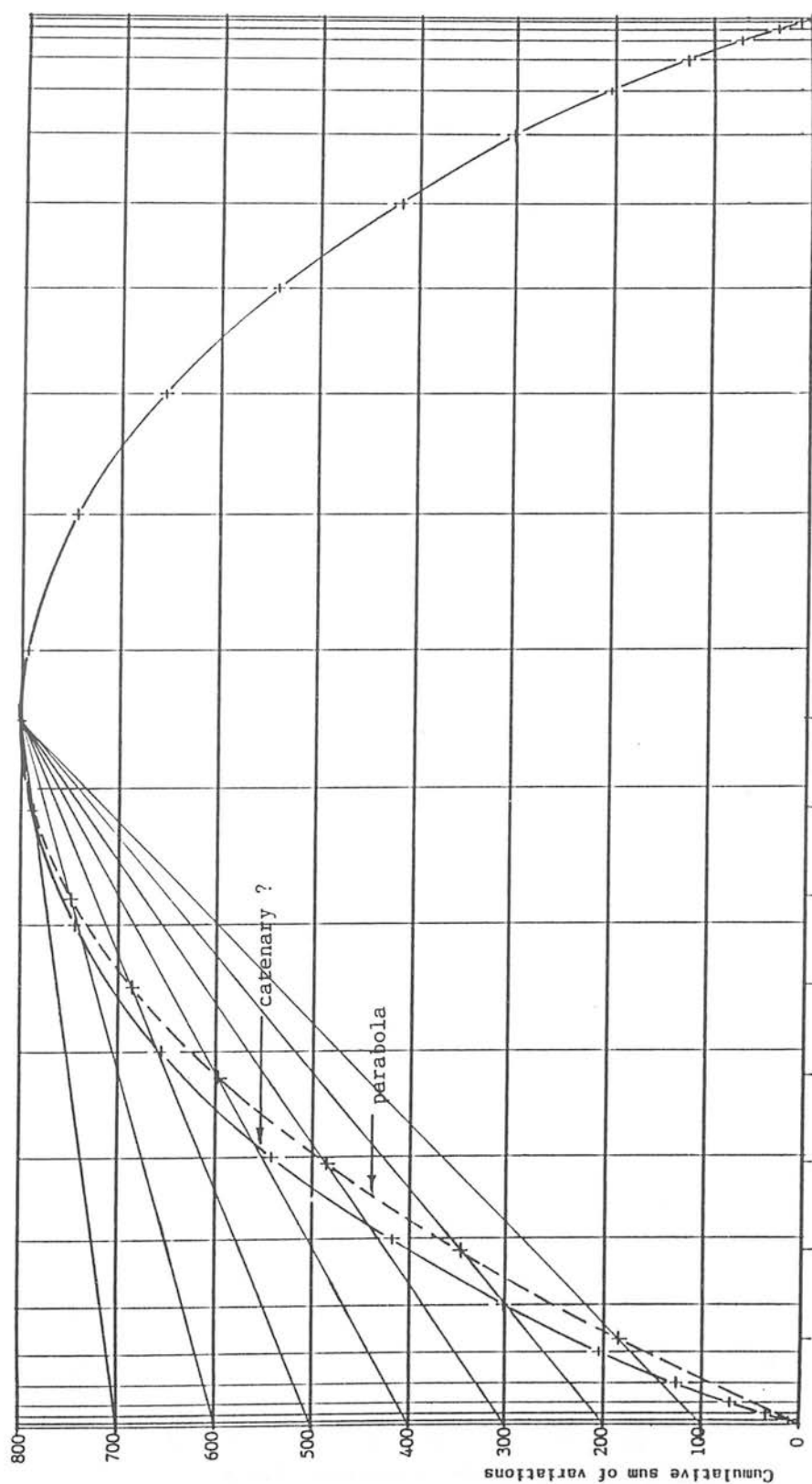
In order to determine the relationship between this skewed curve and that representing a normal distribution, the bell-shaped curve was converted into a cumulative sum type of graph. This was done by designing an imaginary construction which would produce a normal bell-shaped distribution. This is seen on the right hand side of the graph on page 348. This produces a cumulative sum graph (page 349) which is symmetrical, as one would expect. Values for the steps were taken from the actual ordinates to secure greater accuracy. A real example would not provide figures like 9.75 sentences, but in this theoretical construction these values can be used.

For comparison, a parabolic curve is also shown on page 349. A simple practical test may be applied. If this distribution graph is pinned to the wall so that the angle may be adjusted, it will be found that a fine suspended chain matches the curve. It is therefore a catenary, or very close to a catenary curve. This test was also applied to eighty distribution graphs of the works of six modern authors, and where the texts were of sufficient length, the sentence distribution curves could be matched to the curve of the chain. Distribution curves fit the same family of curves, but proportions vary. In short works there are facets due to the steps from one sentence length to another. After sorting, long rogue sentences always appear at the beginning of the curve and may cause a slight variation, but this usually disappears a few points into the curve.

There is a surprising implication. It is accepted that a normal distribution should be symmetrical, with the pattern of the over-average elements mirroring that of the under-average elements. But surprisingly, an area of symmetry is found within the asymmetrical distribution curve. This corresponds to the lower part of the arc of a symmetrical catenary curve. In the graph on page 350, the arc AB is the mirror image of the arc CB. (The first sentence or two may have to be ignored if there are rogue sentences in the text.) It is therefore possible to construct the whole curve, of which the asymmetrical distribution curve is a portion. This is shown on page 351, where the mirror image of the curve is superimposed on the original, and the

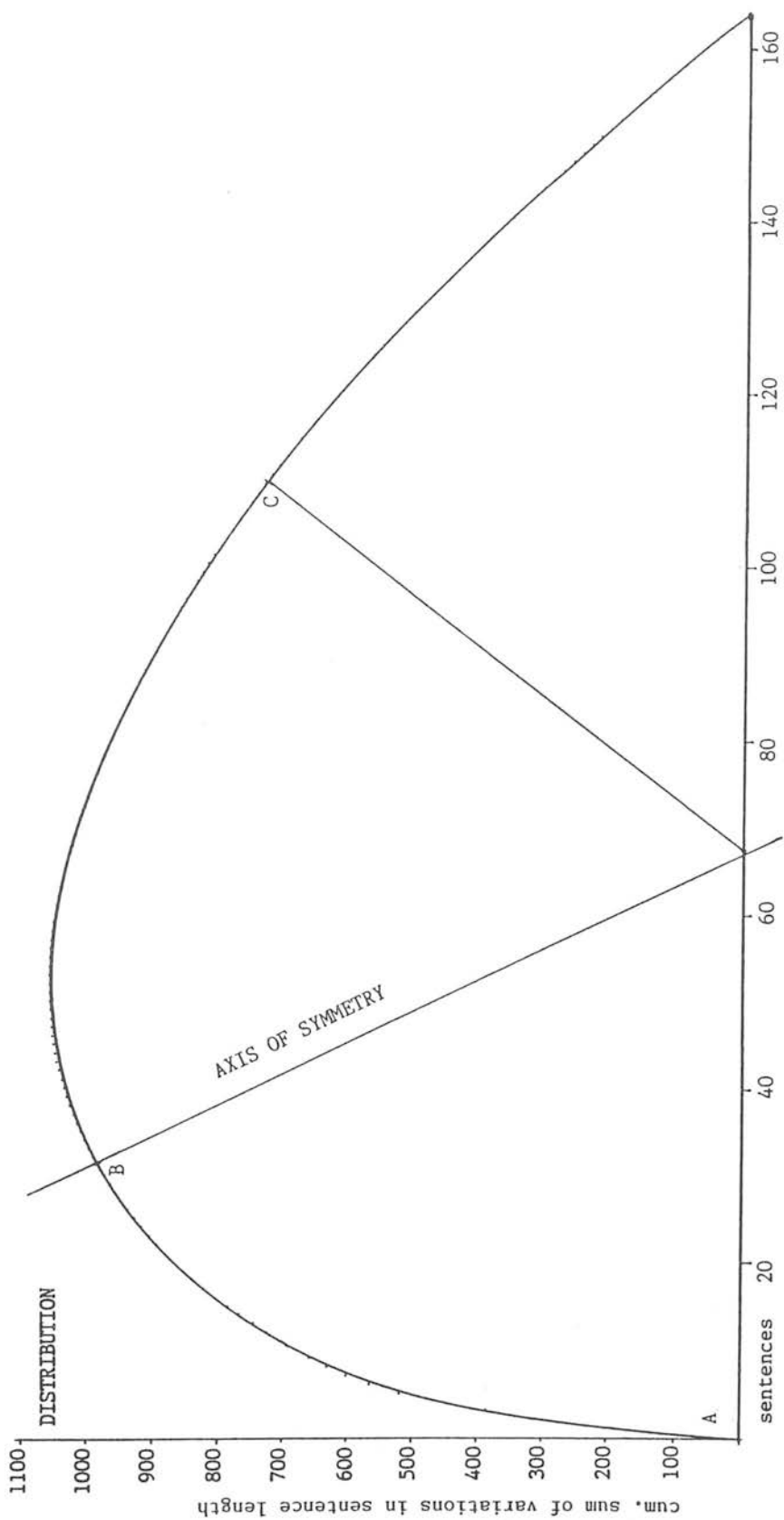


BELL-SHAPED CURVE FROM TABLES OF ORDINATES FOR NORMAL CURVE  
IMAGINARY CONSTRUCTION PRODUCING A NORMAL DISTRIBUTION  
OF "SENTENCE" LENGTHS



"Words" in batches of "sentences" of equal length  
 "SENTENCE" DISTRIBUTION (LONGEST TO SHORTEST) OF IMAGINARY CONSTRUCTION  
 PRODUCING A NORMAL DISTRIBUTION OF SENTENCE LENGTHS + — + — + — +

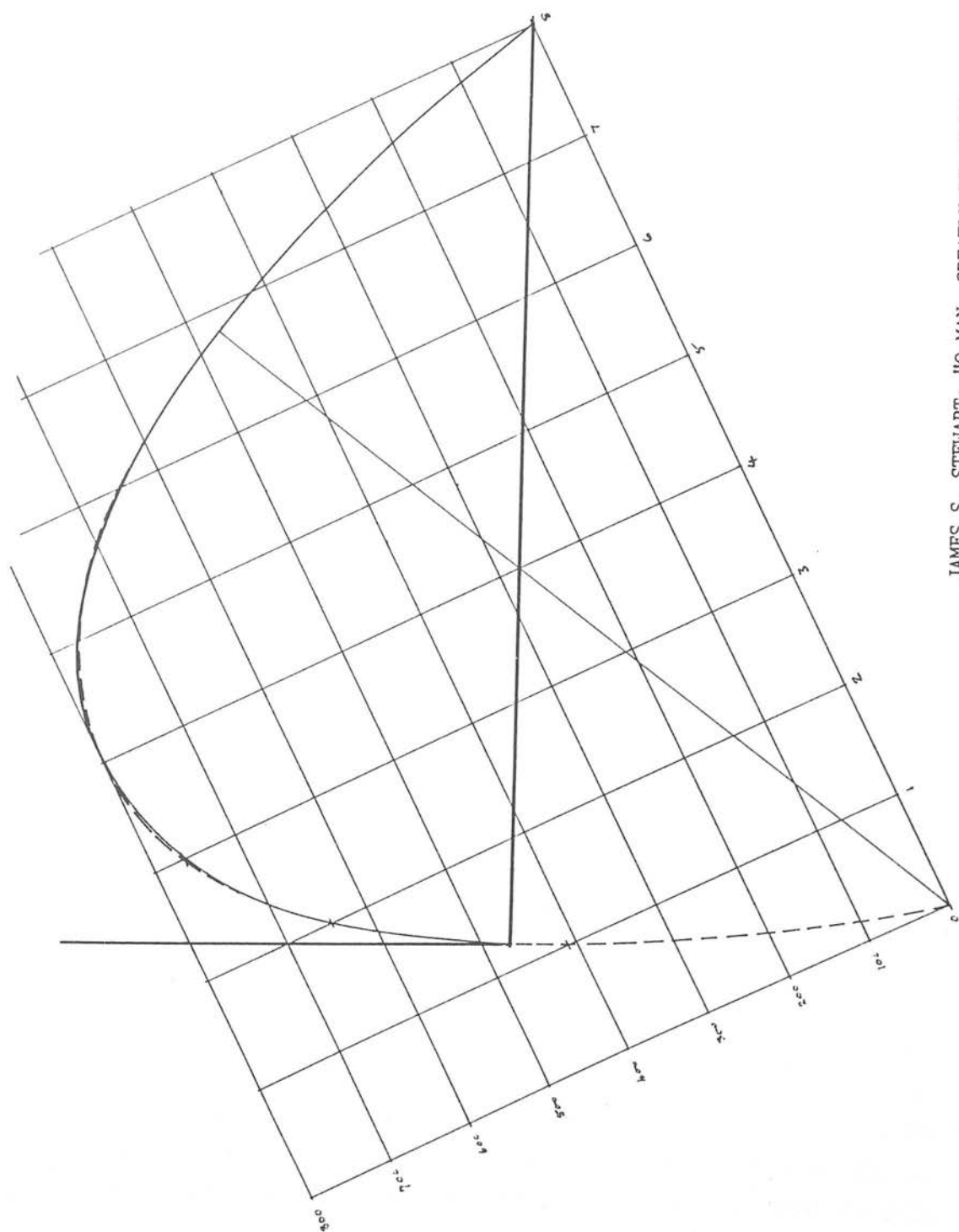




AUTHOR: JAMES S. STEWART

TITLE: "O MAN, GREATLY BELOVED"

A.S.L. 19.34 WORDS: 3172 SENTENCES: 164



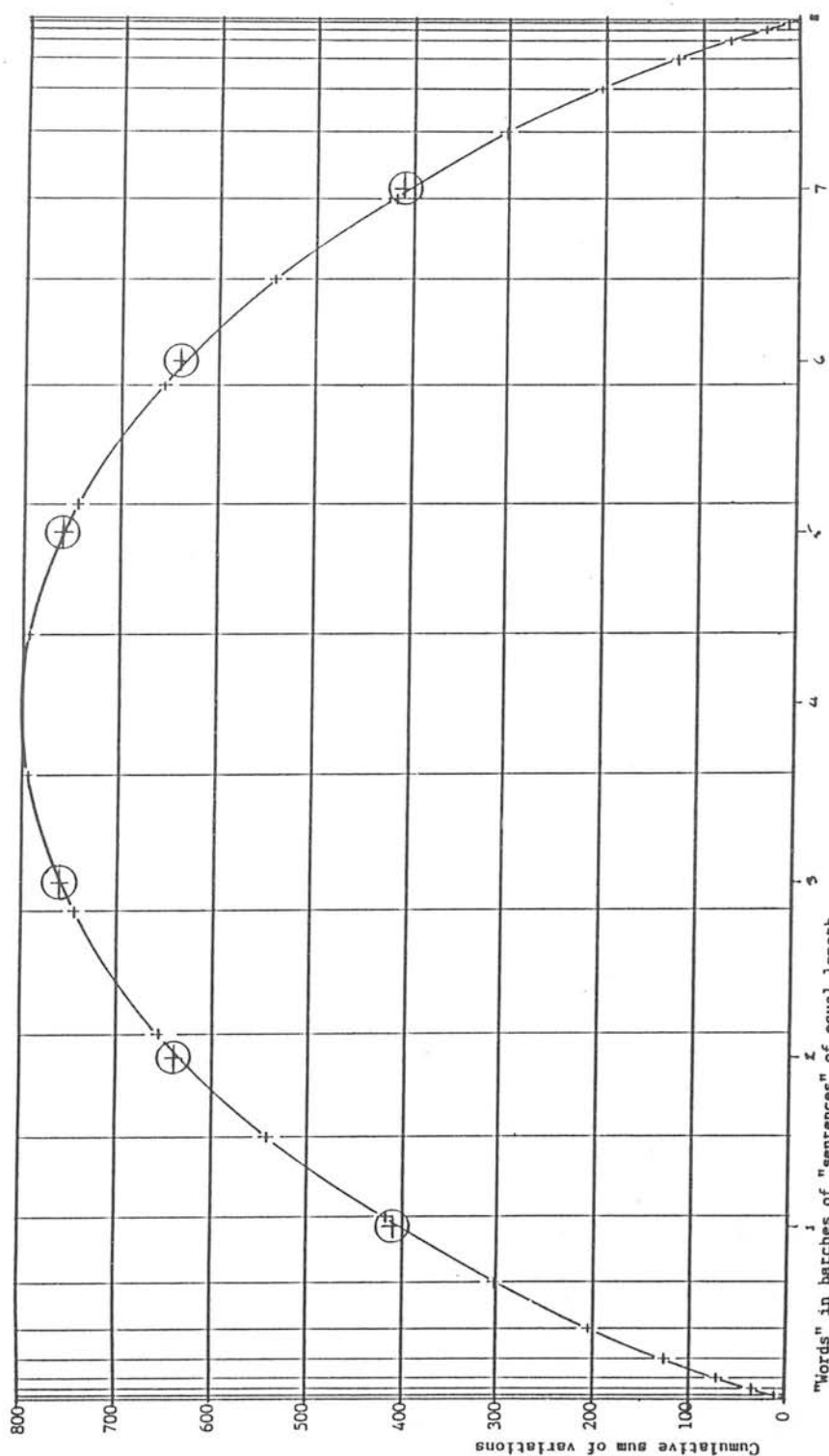
JAMES S. STEWART: "O MAN, GREATLY BELOVED"

areas of symmetry are matched. The parent curve, of which the asymmetrical distribution curve is a portion, is thus identified.

By adjusting the scales, this symmetrical parent curve can now be compared with the symmetrical curve derived from the bell-shaped distribution, to see whether the one fits the other. On page 353, a set of ordinates from the graph shown on page 350 has been plotted on the curve derived from the bell-shaped distribution, and it is seen that they do coincide. This indicates that the cumulative sum curve produced by a sentence length distribution is indeed a **portion** of the curve derived from a normal distribution.

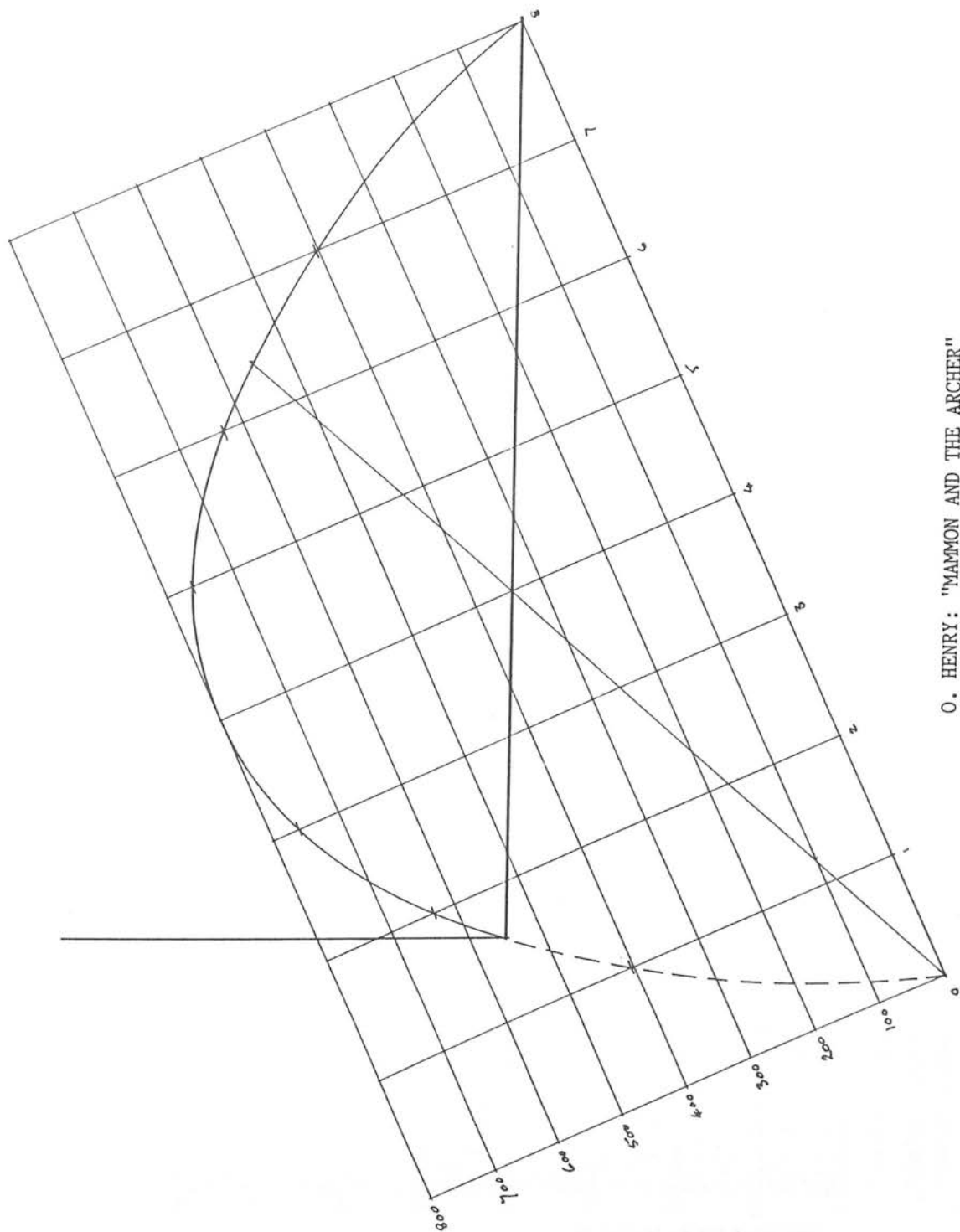
The above case is not an isolated one. Page 354 shows the sentence distribution curve for a short story by O. Henry with its parent curve. Page 355 shows the comparison with the curve derived from the bell-shaped curve. Parabolic and catenary curves may vary in proportion, and the parent curves do vary considerably in proportion, yet belong to the same family of curves. Other experiments show that the height of the curve depends upon the author's mood which is expressed through the contrast between the distribution of longer and shorter sentences. The percentage of the distribution curve in relation to the parent curve also varies from work to work, yet all these curves belong to the same family, given sufficient length of text.

The extent of the portion which the asymmetrical curve represents also varies. It may be expressed as a percentage of the base of the parent curve which is subtended by the asymmetrical portion. Any curve of this kind may therefore be classified by two percentages, the first referring to the extent of the portion, and the second referring to the height of the parent curve in relation to its base. For example the classification of James Stewart's sermon (page 346) would be simply 84.5%/70.2%. O. Henry's story (page 354) would be represented by 80%/52%. Such figures depend, of course, on using consistent scales in preparing all cumulative sum graphs. In these examples the ratio of the scales of the X and Y axes was 100:140. This system may be applied to samples of other kinds. For example, the "Retail Prices Index %age Changes on 1 Year Earlier" was 90/52.6 for a recent 12 month period. The data for rainfall January 1979-December 1989 provide the figures 100/- (Normal). This result is probably due to the fact that the data

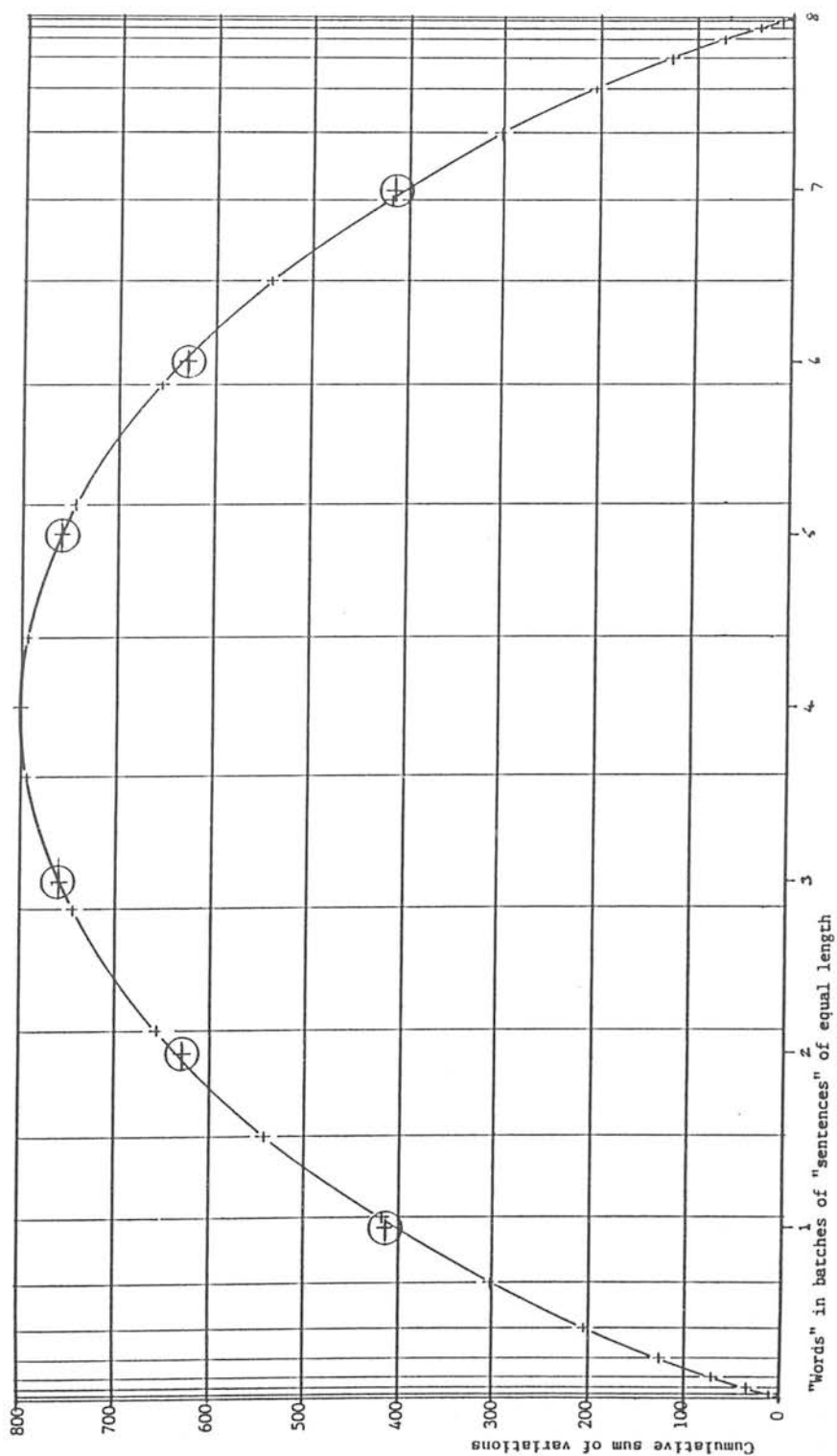


"SENTENCE" DISTRIBUTION (LONGEST TO SHORTEST) OF IMAGINARY CONSTRUCTION  
PRODUCING A NORMAL DISTRIBUTION OF SENTENCE LENGTHS

⊕ Ordinates from  
JAMES S. STEWART: "O MAN, GREATLY BELOVED"



O. HENRY: "MAMMON AND THE ARCHER"



⊕ Ordinates from  
O. HENRY:  
"MAMMON AND THE ARCHER"

"SENTENCE" DISTRIBUTION (LONGEST TO SHORTEST) OF IMAGINARY CONSTRUCTION  
PRODUCING A NORMAL DISTRIBUTION OF SENTENCE LENGTHS

were derived from multiple sources. Likewise Capital Gains Tax Indexation Allowance March, 1982 - Dec., 1990 gave a normal distribution.

It therefore requires only two percentages to allow the cumulative sum graph of any sentence distribution to be delineated by using a catenary curve. Why sentence distribution curves should approximate or match a catenary is not yet known.

## Appendix B

### Sentence Length and Chaotic Distributions

With the publication of James Gleick's *Chaos: Making a New Science* [27] and Ian Stewart's *Does God Play Dice?: The New Mathematics of Chaos* [58], the possibility that sentence length distributions might be related to chaotic distributions had to be considered. The first approach to this was mathematical and involved tracing iterations of mathematical formulae which produced chaotic sequences of several kinds. The second was to set up a practical experiment in the form of a water drip, the flow of which could be adjusted so that different patterns could be observed at different rates of flow. Finally, results obtained using these methods were compared with sentence length distributions, by means of sections through three dimensional (3D) graphs, obtained by plotting the intervals/sentences  $n:n+1:n+2$ . It is not always possible to detect a pattern in a complex 3D graph where the distribution of the plots lacks perspective, but sections through the graph may reveal the pattern if one is present.

#### B.1 Iterations

In Appendix A it was shown that when sentence length distributions are expressed as a cumulative sum graph with the sentences sorted in order of length, longest to shortest, the distribution curve is seen to be a portion of a catenary (or similar) curve. If a normal distribution were to be expressed in

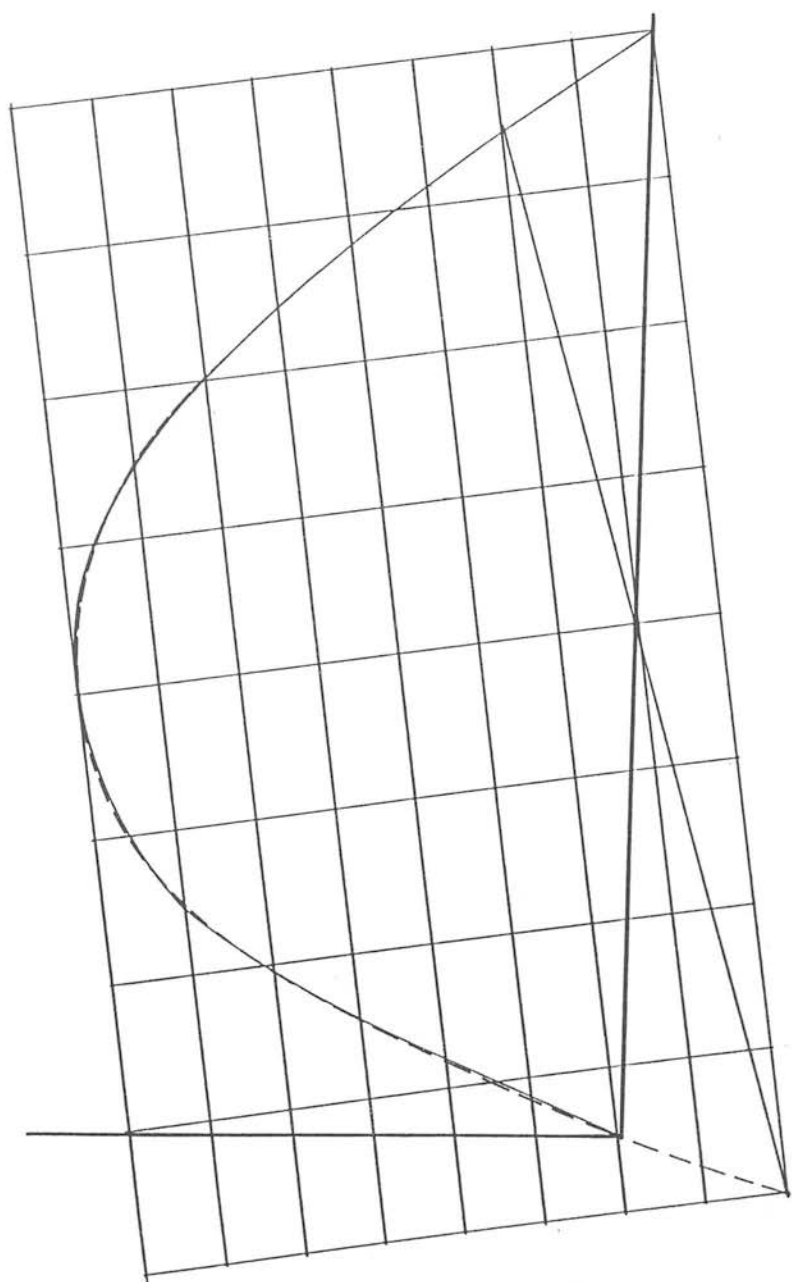


the same way, it would produce a whole catenary (or similar) curve. A mathematical model was selected to determine whether similar behaviour could be found, and the model chosen was  $X_n = kx^2 - 1$ . Stewart [58, p. 20] indicates that chaos sets in around a figure of 1.5 for  $k$  and is still found at a value of 2. A series of trial iterations in this area revealed the highly structured nature of chaotic patterns. Stewart says that at  $k = 1.74$  you see "well-developed chaos" [58, p. 20]. At this value the curve appears to have an area of internal near-symmetry and behaves in the same way as graphs derived from sentence length distributions. The curve may be projected to produce the symmetrical parent curve, as shown on page 359. The curve is slightly different from that derived from sentence lengths and lies between a catenary and a parabola. When successive intervals are plotted in a 3D graph ( $n:n+1:n+2$ ), this value gives a very precise curve which is shown on page 360. This curve may be developed in two dimensions as shown on page 361.

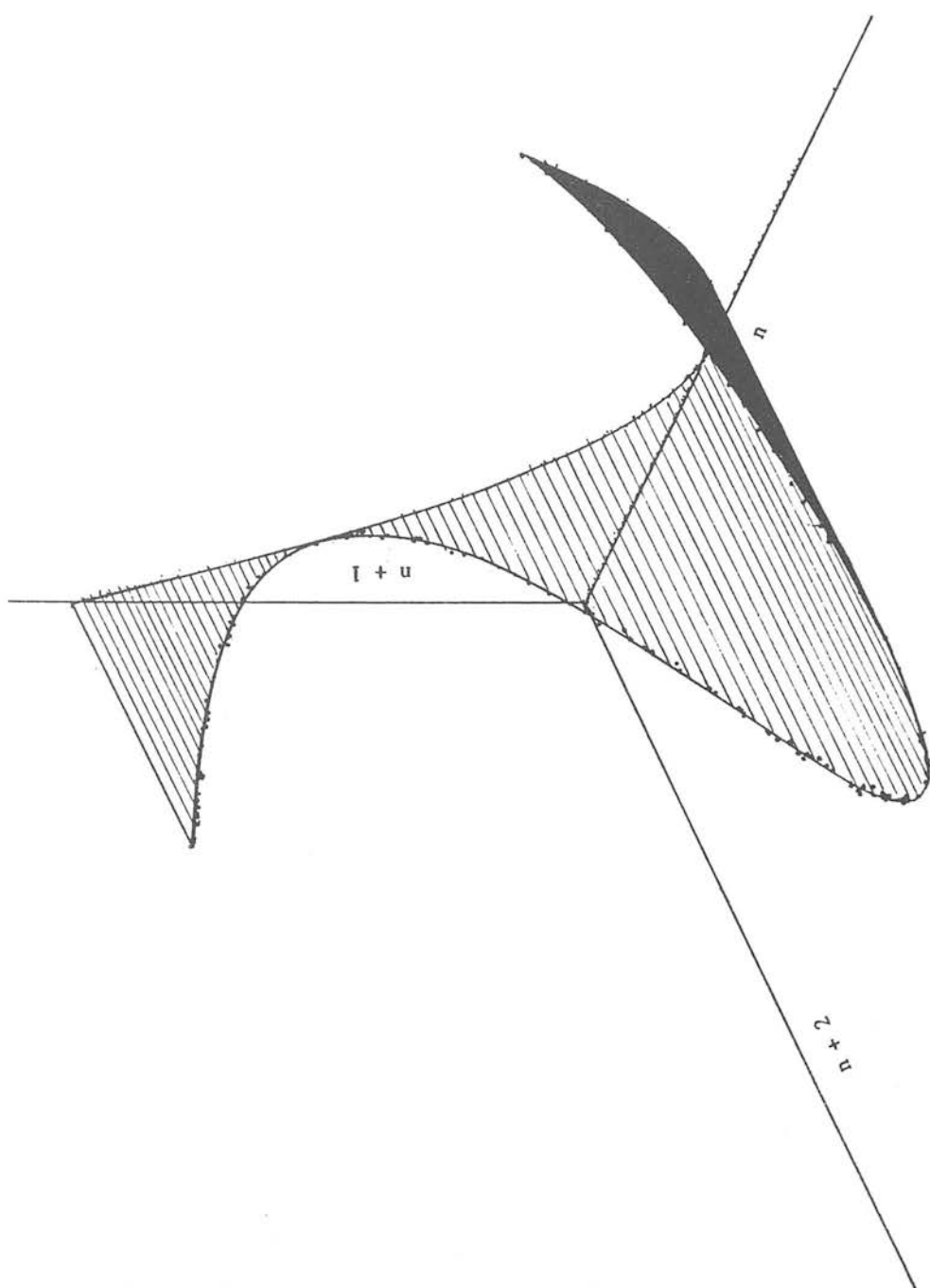
Not all values give a curve with an area of internal symmetry. When  $k$  is given a value of 1.55 the curve is faceted (page 362) and produces the variation in the 3D graph shown on page 363. This faceted curve may be a stage in the development of a form which is found where  $k = 1.75$ . At this value the graph (page 364) assumes the form of a trapezium. This indicates that after a number of iterations the series becomes a repetition of three values - a triplet. Other values produce a variety of faceted forms.

## B.2 The Water Drip Experiment

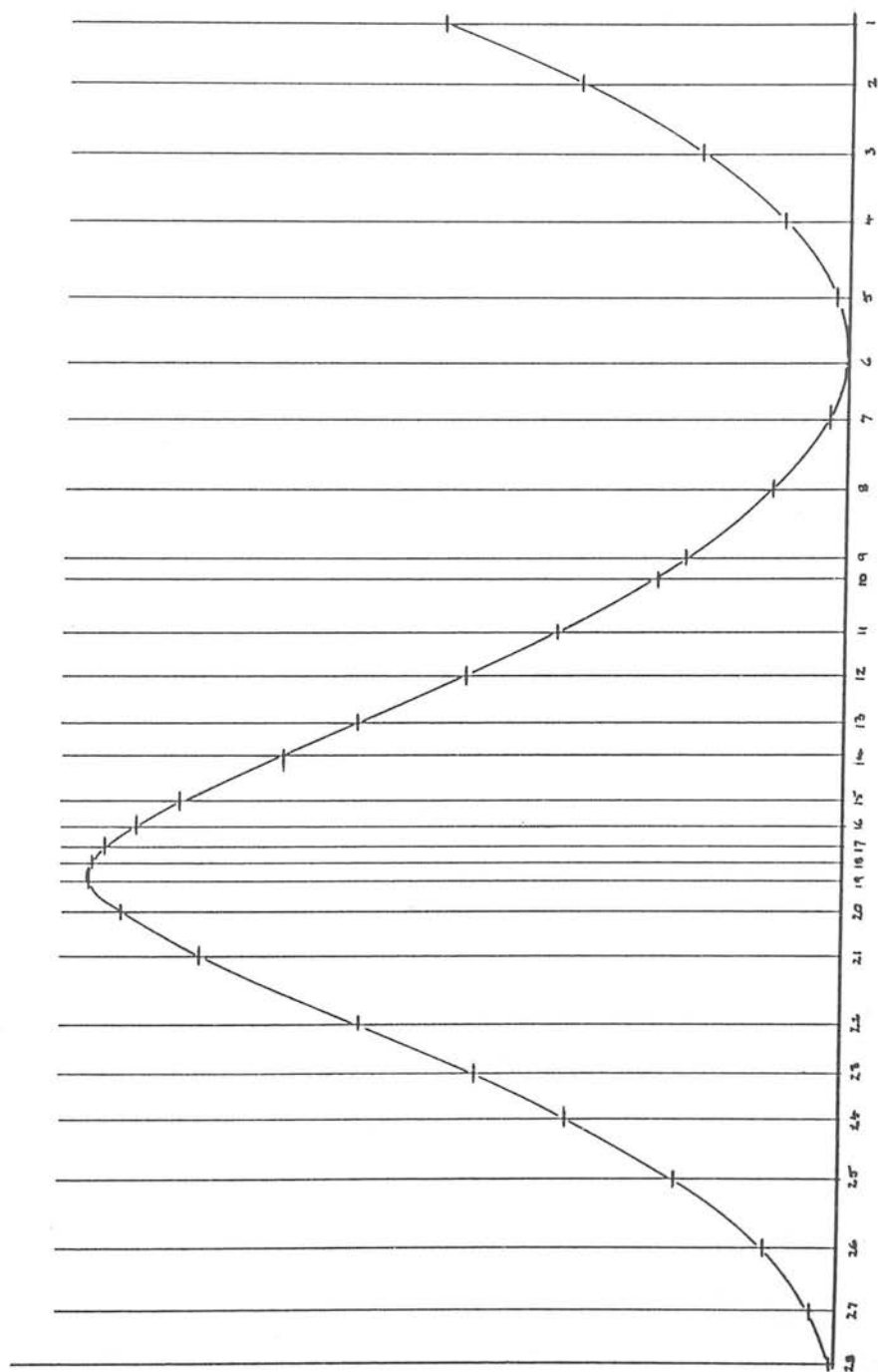
First experiments showed how sensitive a water drip can be to minute variations in water pressure and vibrations. A simple symmetrical system was devised consisting of a storage tank with a short rubber syphon tube ending in a symmetrical glass dropper. The head of water was limited to a few inches. Most samples involved only 30 to 100 drips and the loss did not affect the head of water. A clamp on the rubber tube provided flow control. The drips fell about five feet on to a metal plate giving a sharp sound which was picked up by a microphone and recorded on a reel-to-reel tape recorder which could be played back at quarter speed, stretching the signal so that it could be measured on the tape. These measurements were used to plot



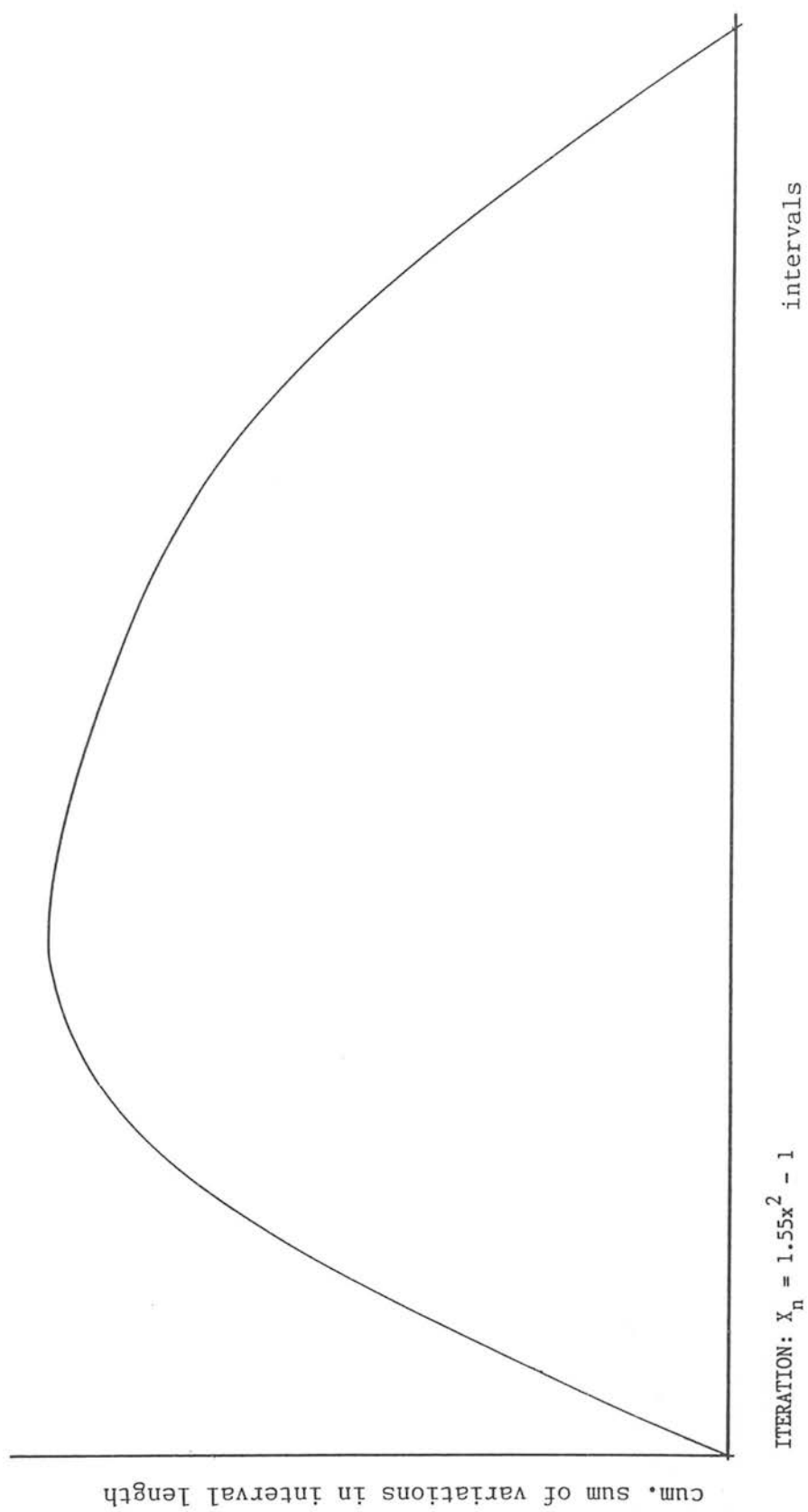
ITERATION:  $x_n = 1.74x^2 - 1$      $x = 0.54321$

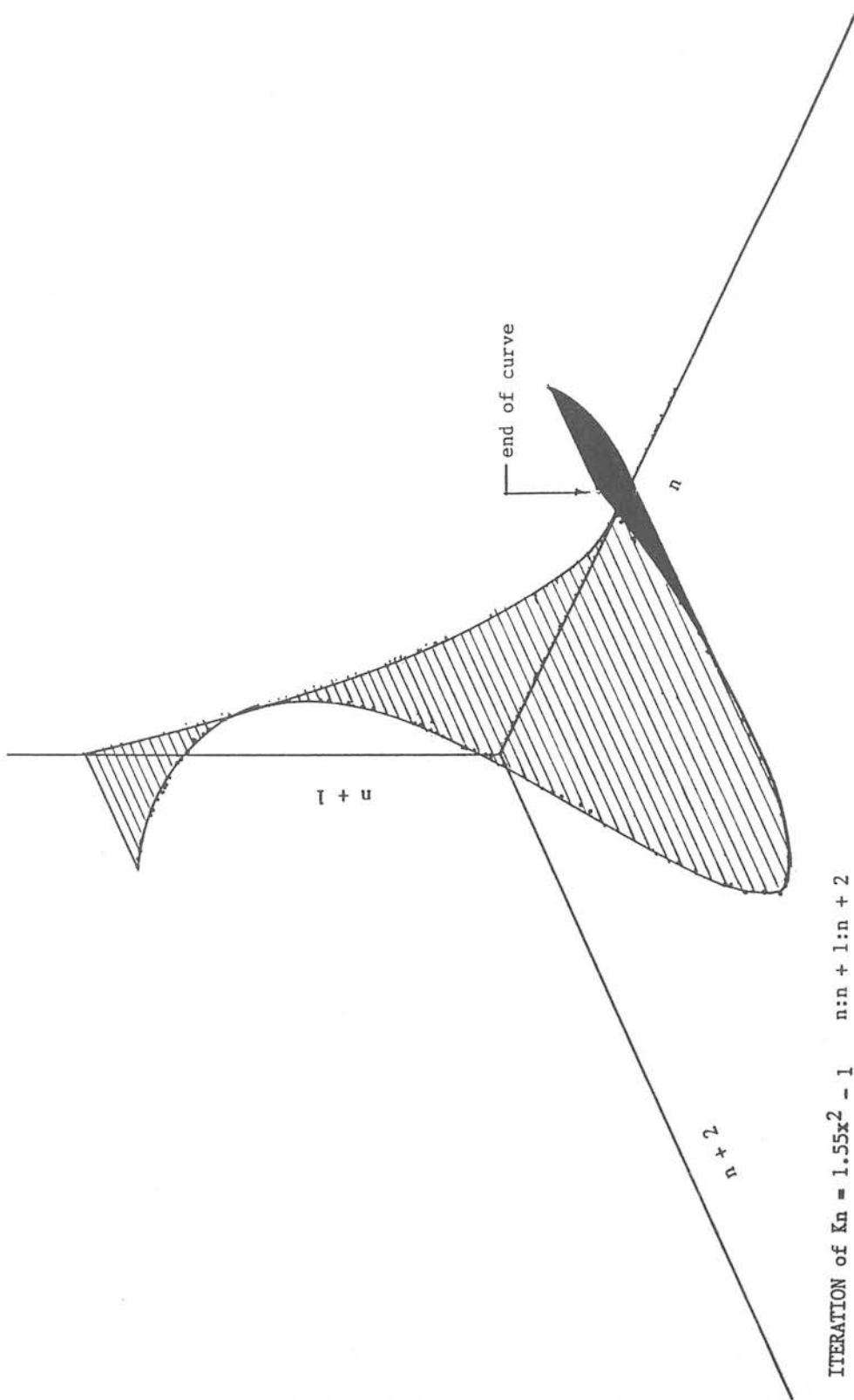


ITERATION of  $X_n = 1.74x^2 - 1$      $n:n + 1:n + 2$   
 (Symmetrical type)

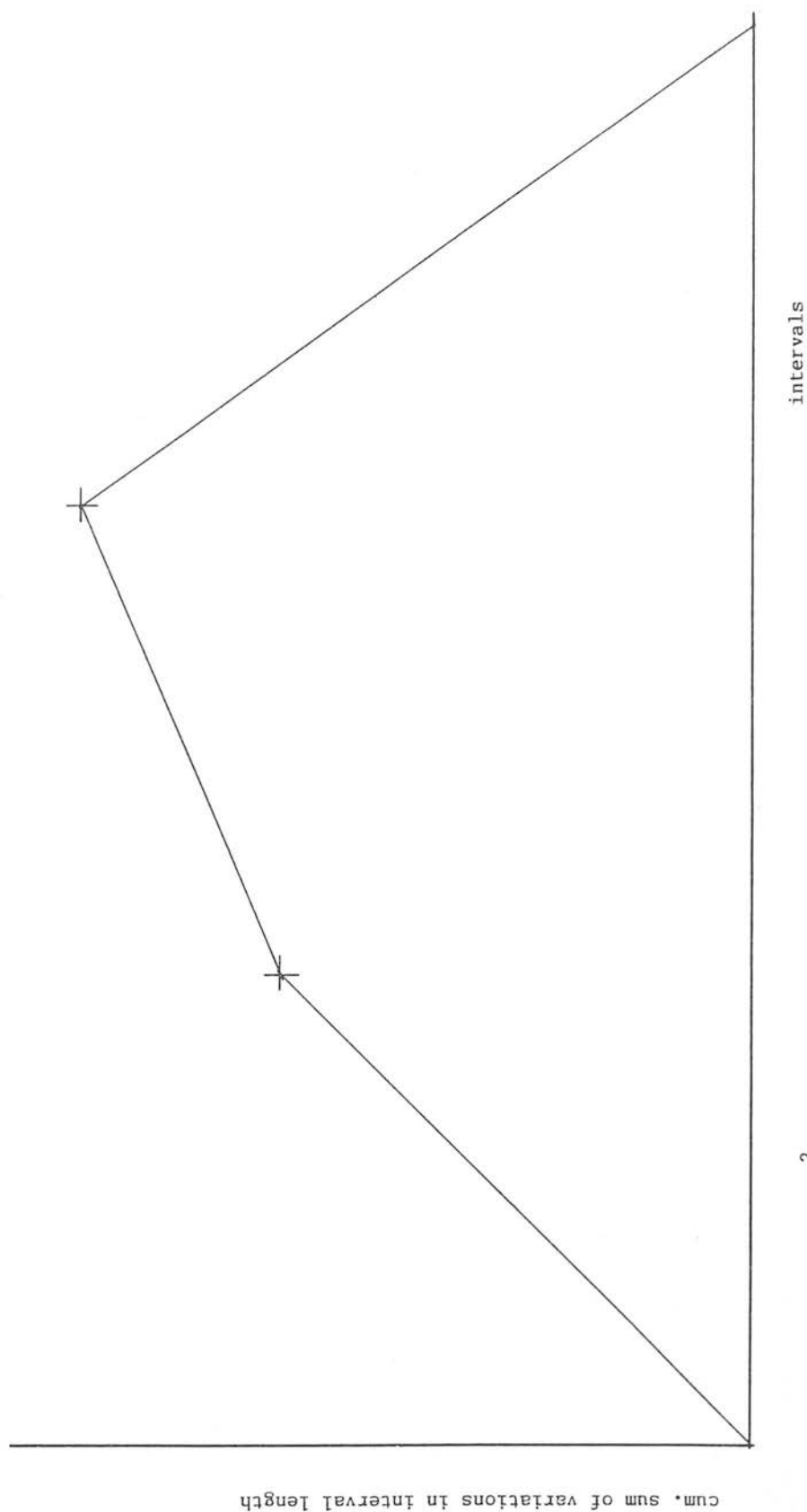


ITERATION of  $X_n = 1.74x^2 - 1$   
DEVELOPMENT OF 3-DIMENSIONAL GRAPH





ITERATION of  $Kn = 1.55x^2 - 1$   $n:n + 1:n + 2$   
 (Asymmetrical type)



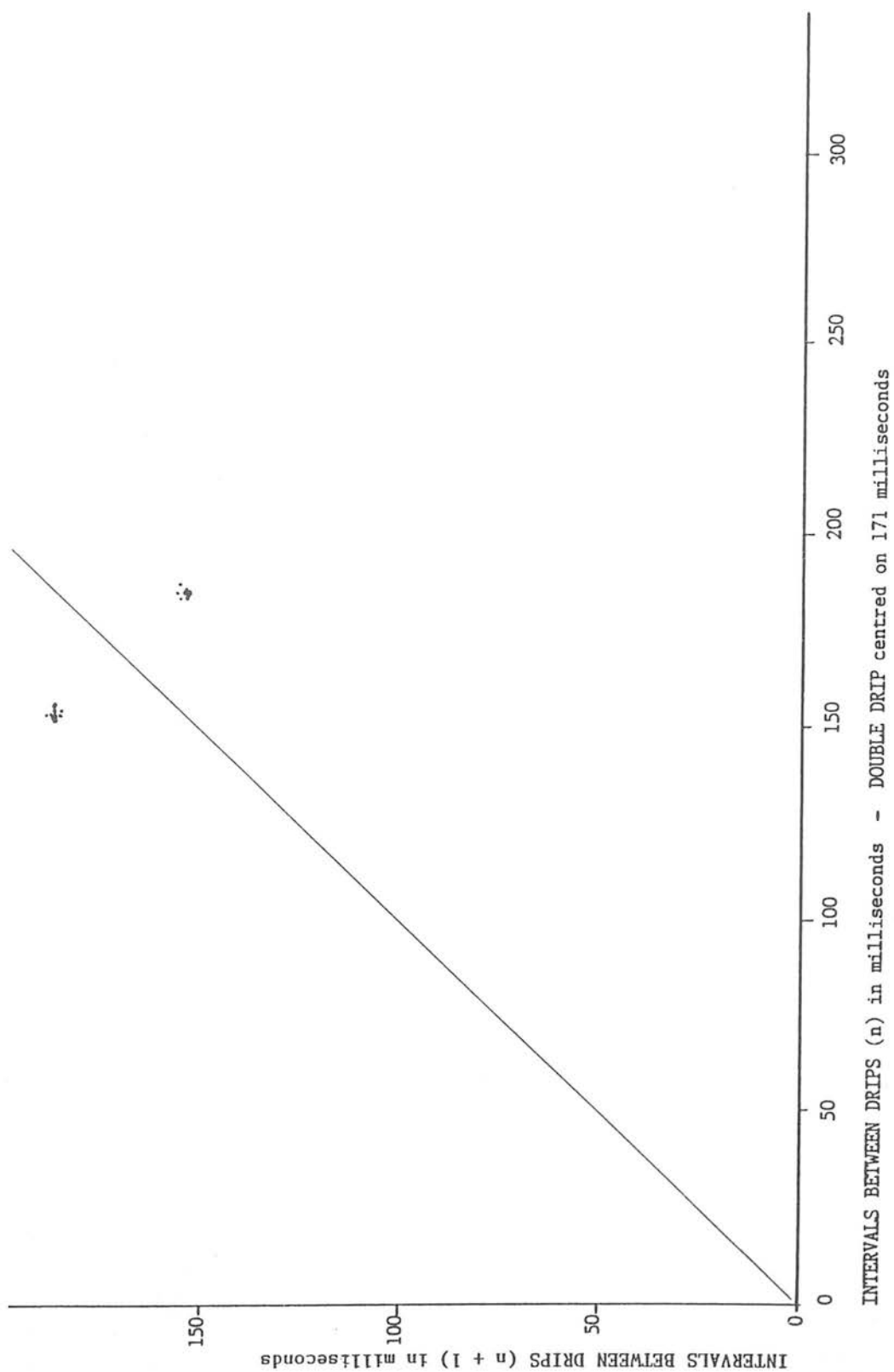
graphs in two and three dimensions by taking the sequence of intervals in groups of two or three, i.e.  $n:n+1$  for 2D graphs and  $n:n+1:n+2$  for 3D graphs. An accuracy of approximately 1% was possible with slow drips, the results becoming "noisier" with faster rates of flow. The graph on page 366 shows the degree of scatter where the noise due to vibration, inaccuracies and the onset of chaos were at a minimum.

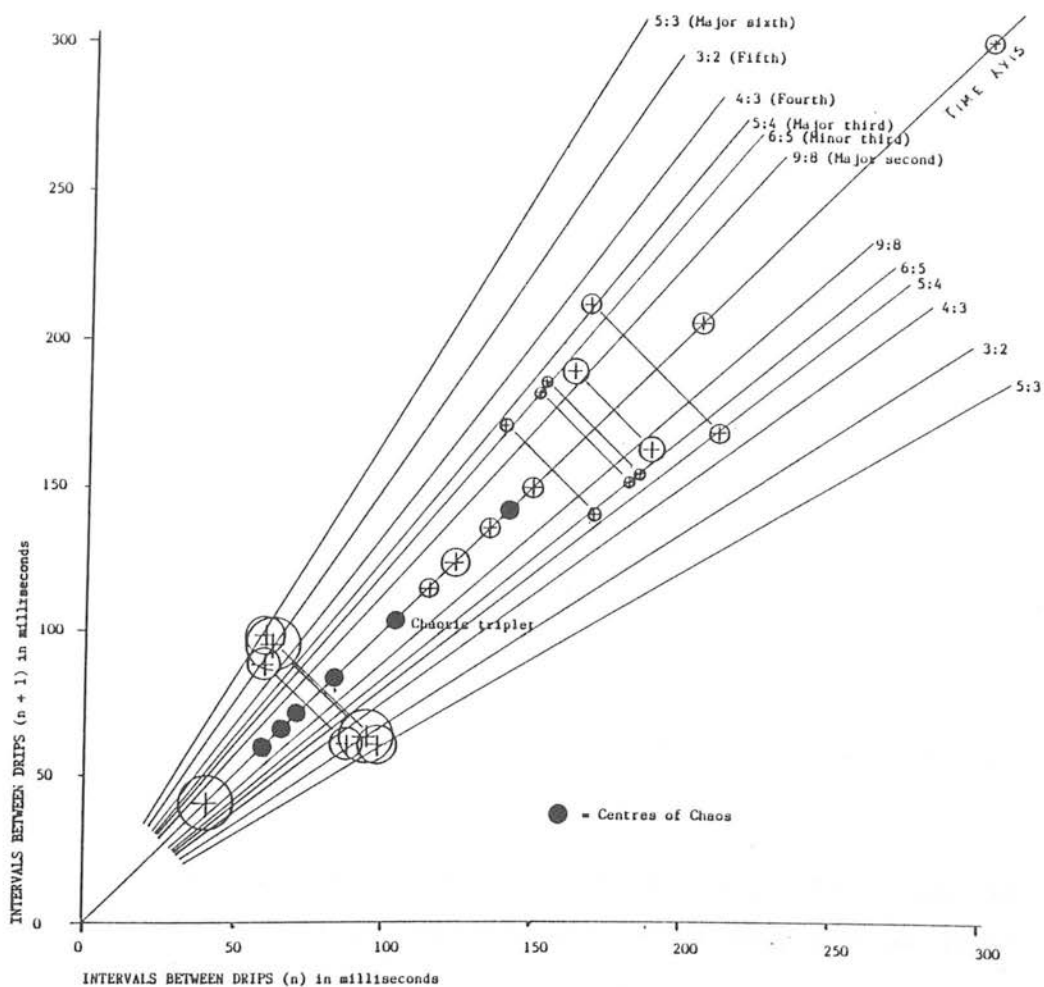
The limitations of the apparatus soon became evident. To achieve accurate tuning would need vibration-free laboratory conditions, a light beam and photocell, processor and oscilloscope. Sample measurements were taken at intervals, as the rate of flow was increased from a slow periodic drip to fast laminar flow. The chart on page 367 shows these samples along a time axis. The samples do not necessarily occur at important nodal points but they show the progression from one pattern to another.

Drips were found in the periodic mode up to approximately 200 milliseconds. Thereafter, as the rate of flow increased the mode changed at various points to a double drip. The amplitude of each double drip varied. Between these points areas of chaos were observed. Listening to the tape recording of a drip in slow periodic mode at slow speed, it was found that as the rate of flow was slowly increased, an unevenness developed in the periodic rhythm. The unevenness would develop into an irregular burst. The irregularities increased with the flow rate until the rhythm broke up completely into chaos with no discernible pattern. This suggested that there were nodal points at intervals along the time axis at which the drip was periodic. As these periodic modes appear to have the characteristics of a resonance, it is possible that the occurrence of nodal points along the time axis has a harmonic structure, i.e. the intervals between them may be related by simple whole number ratios in the way that the frequencies of the notes of the musical scale enjoy a harmonic relationship.

On the chart on page 367, the diameters of the circles indicate approximately the degree of scatter. The scatter derives firstly from noise in the system, from vibrations such as traffic noise and from inaccuracies in measuring, and secondly from the tendency within the system itself to go into a chaotic mode. Generally the degree of scatter in a periodic sample indicates the distance from a nodal point on the time axis.





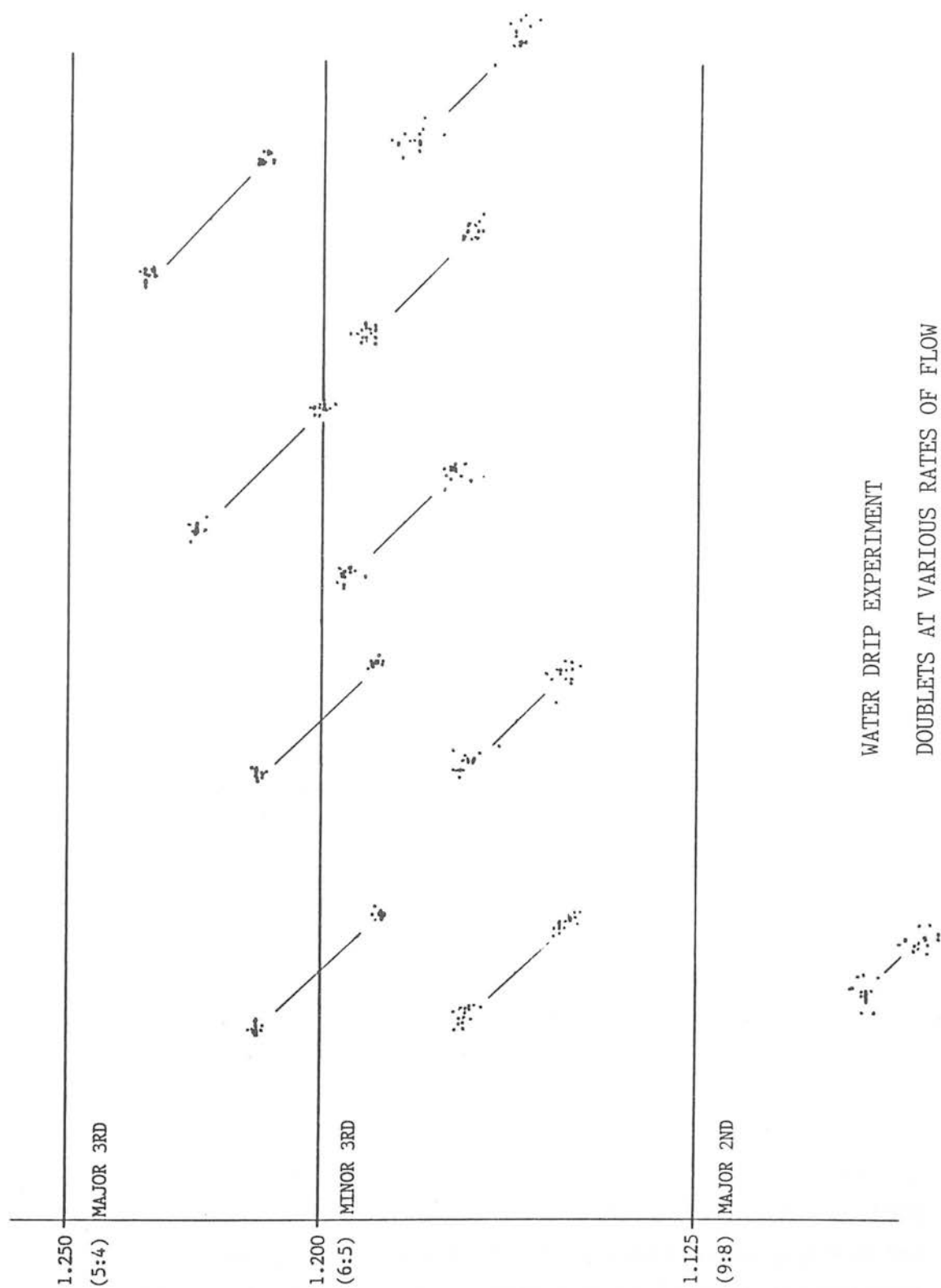


Between the nodal points, double drips, or doublets, were found. This does not involve precise period doubling, i.e. they are not "octaves" of a fundamental frequency. The "amplitude", the ratio of one interval to the next, is variable and unpredictable. To give some measure of amplitude, lines are drawn on the chart on page 367 giving the simple whole number ratios which also underlie musical intervals running from 9:8 (major second) to 5:3 (major sixth). All the doublets were found within that range. The amplitude of a doublet does not depend on the flow rate. For example, a doublet centred on 190 milliseconds has a ratio of 5:4 in the intervals between drips, while one centred on 168 milliseconds has the smaller ratio of 6:5. Further down the time axis at 80 milliseconds, the greater ratio of 3:2 is found. While the rate of flow does not determine to which amplitude the mode will flip, it is suspected that the rate of change in flow determines this, at least to some extent. That is, the speed of approach to the knife edge at which the system flips to another mode may determine the ratio of the doublet.

This degree of unpredictability may point to a scaling effect in the relation between the position on the time axis and the ratio of the doublet. This would not be surprising as scaling is an integral part of chaotic systems and is also frequently found in the apparently random distribution of sentence lengths in literature.

It was noted that despite the tendency of faster rates of flow to produce more noise, there did seem to be some evidence, especially at the lower rates of flow, that there is less scatter at points which lie on the harmonic lines. On page 369, some samples are shown lying across the 6:5 ratio line. It was particularly easy to find such instances on the down side of this ratio at a value of about 1.18. With more difficulty, doublets could be found with values slightly over 1.2. This is reminiscent of a phenomenon found in a flageolet or recorder. In these instruments it is possible by overblowing to raise the pitch of a note very slightly. It is very easy by underblowing to drop the note by as much as a semitone, which would be the equivalent of the distance on the chart between the 9:8 ratio and the 6:5 ratio. The doublets all fall within that range. The scatter is reduced to the minimum on the 6:5 line.

This suggests that the doublets display a comparative state of equilibrium, though of a rather unstable kind, when they fall on these

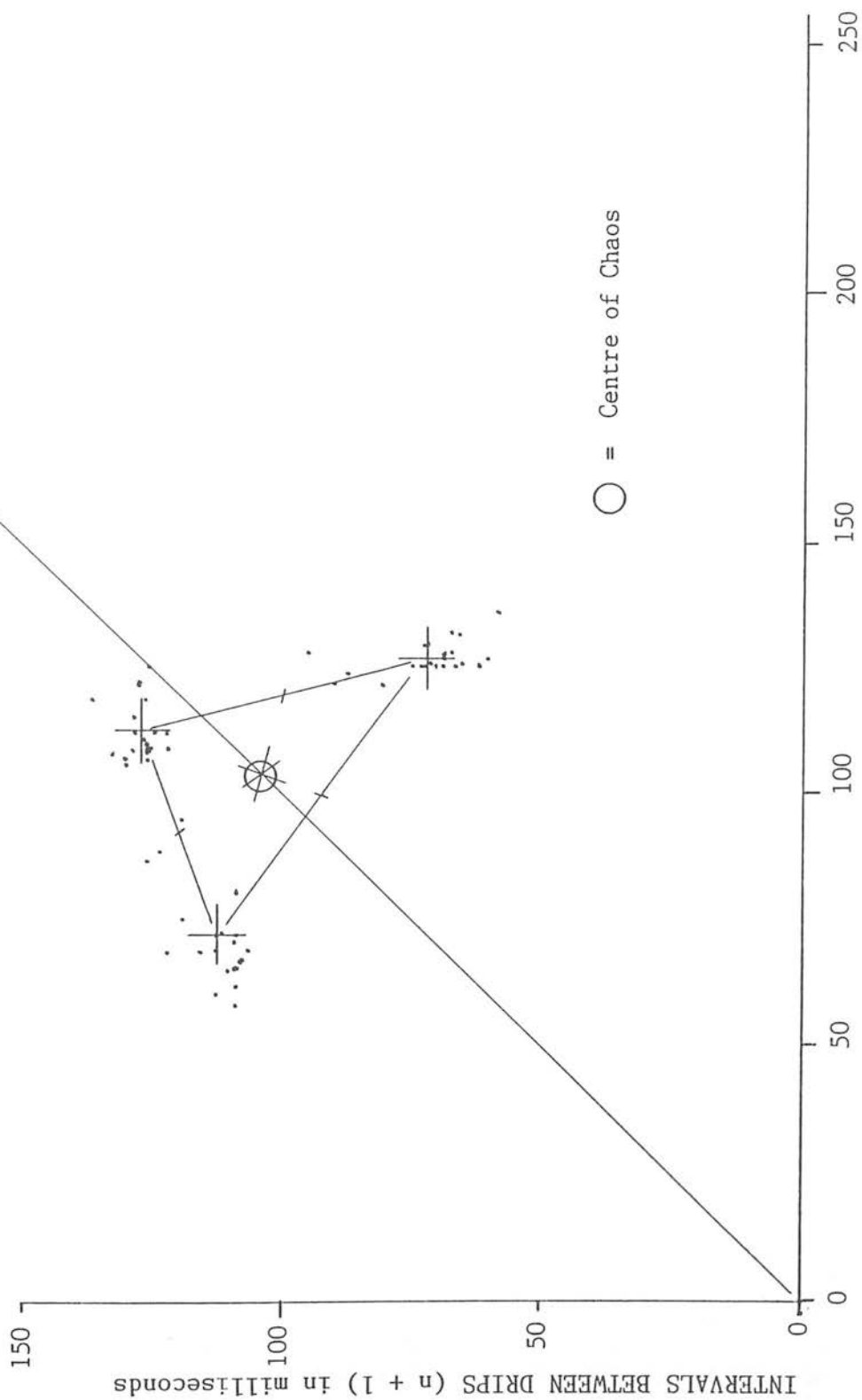


harmonic lines. This points to a harmonic structure in the way the mode flips from the periodic to the doublet. It is perhaps too much to claim that there is a "locking-on" mechanism favouring these simple ratios. In one experiment a doublet at the 1:1.18 ratio was left to run on to see whether it might migrate towards the 1.2 band, thereby locking on to the 6:5 harmony. In fact it migrated to periodicity and the result was inconclusive. The phenomenon of the periodic mode flipping to the doublet may be compared to the effect of driving a rising or descending tone down a tube. While the driving tone changes smoothly in pitch, the sound emerging from the other end of the tube changes in a series of abrupt steps as one resonance flips to the next. These resonances lock on to the simple whole number ratios related to the fundamental provided by the length of the tube.

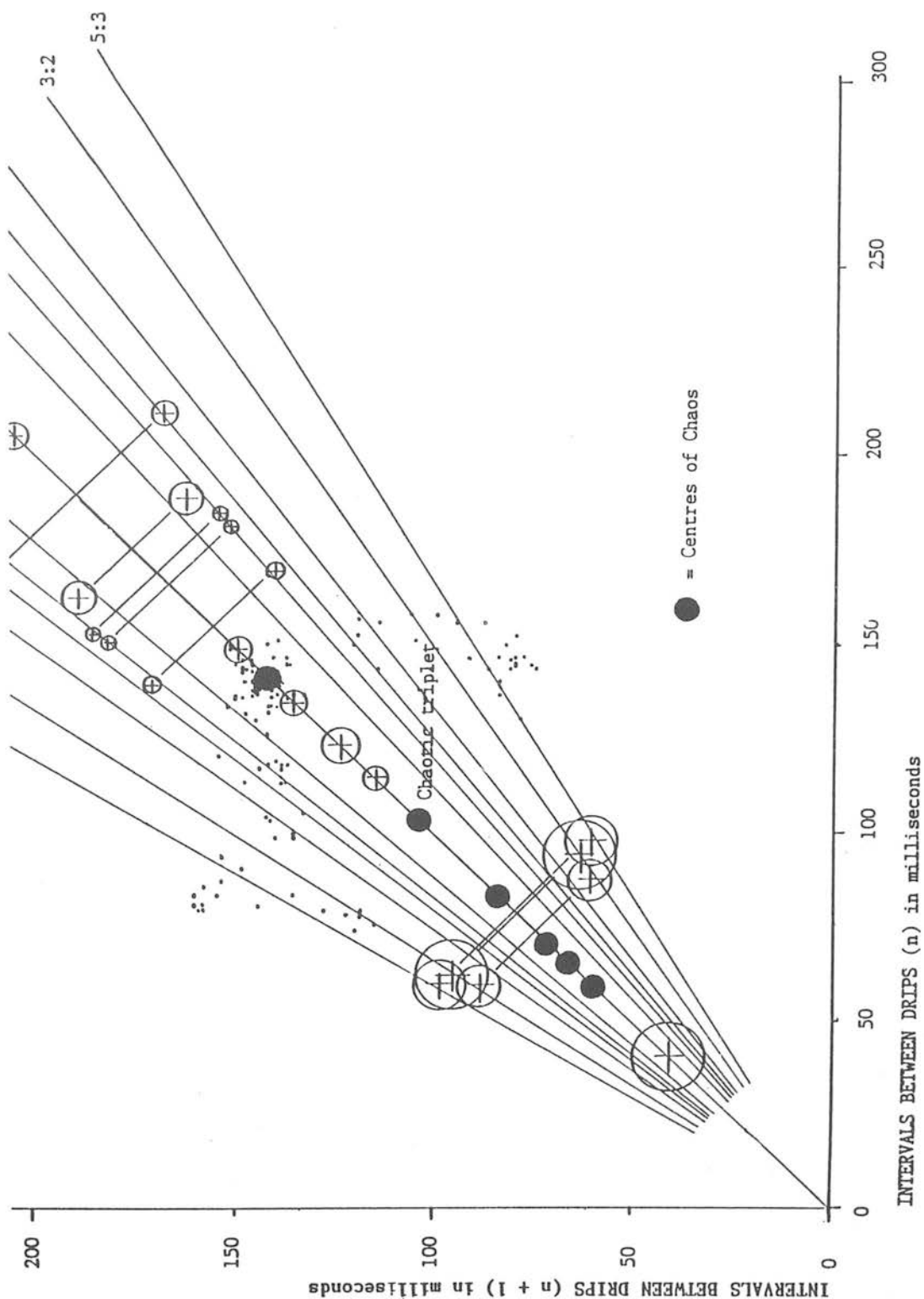
The triplet shown on page 371 appeared at 103 milliseconds, when a triple drip could be detected by ear. It seemed possible that this might be a steady flipping between the periodic mode and a doublet, but in fact turned out to be an asymmetrical chaotic triplet with no simple relationship between any of the intervals involved.

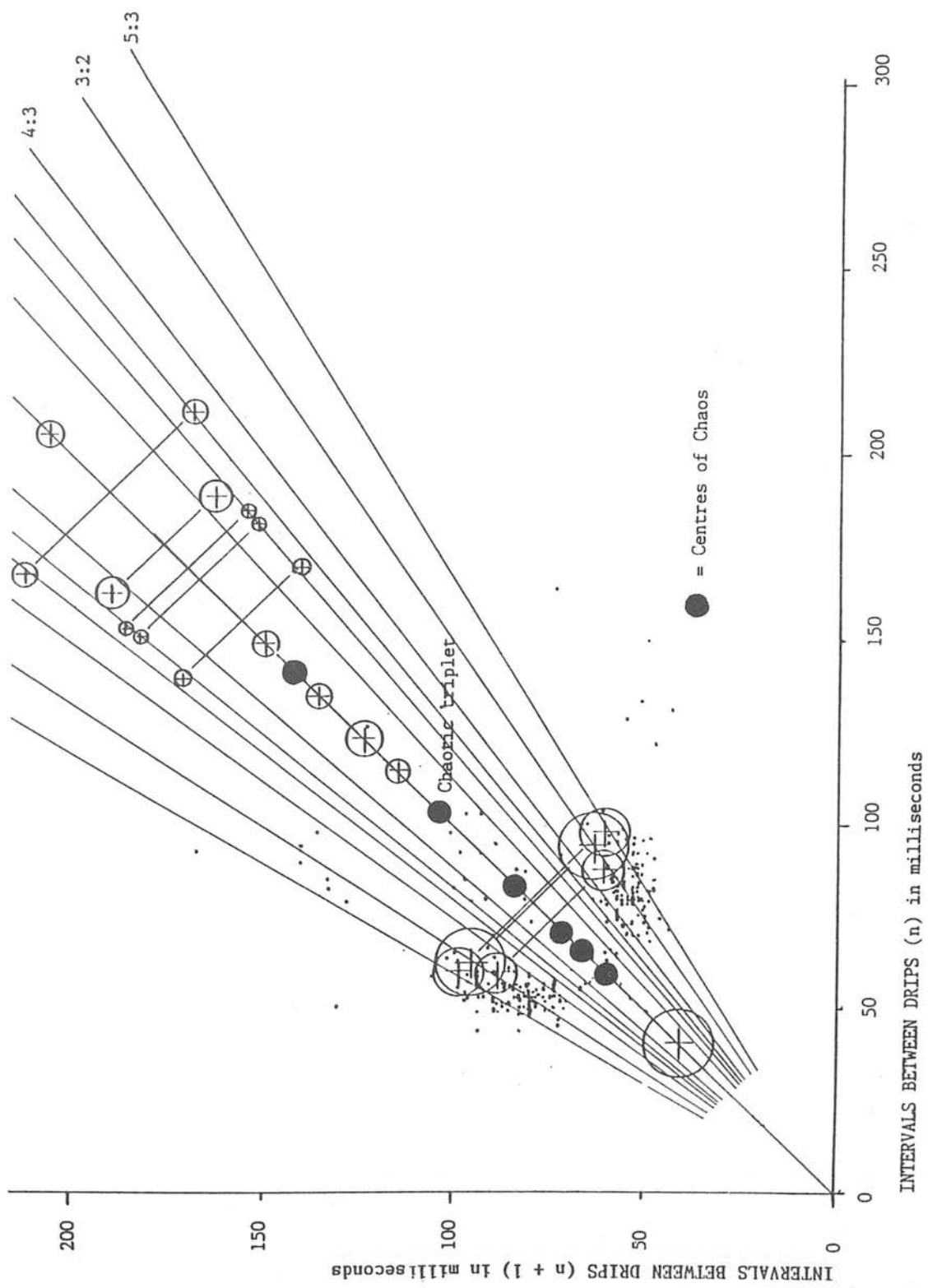
Chaotic modes occur between the nodal points of periodic modes and doublets. There is no precise knife-edge separating them, but elements of resonance persist well into chaotic periods. As the flow rate is increased from that providing a periodic nodal point, scattering increases while an indication of the resonance persists. Then there occurs a situation of "pure" chaos. As the flow rate is increased further and the position of a doublet is approached, the chaos begins to coalesce around the twin centres of the doublet. Similar patterns are detected between the doublet and the next nodal point. On either side of the point of "pure" chaos there is an area of chaos mixed with the characteristics of the resonance being departed from or being approached. The graph on page 372 shows the onset of chaos from a nodal point of periodicity at 140 milliseconds. Page 373 shows chaos coalescing on a doublet at 65 milliseconds, and page 374 shows the onset of chaos from a doublet at 60 milliseconds.

As laboratory conditions were not available it was not possible to replicate the experiments of the Santa Cruz mathematicians [58, p. 190] which produced "smoke trail" 3D pattern corresponding to the graph of the iteration shown on page 360. Several graphs showed the persisting elements

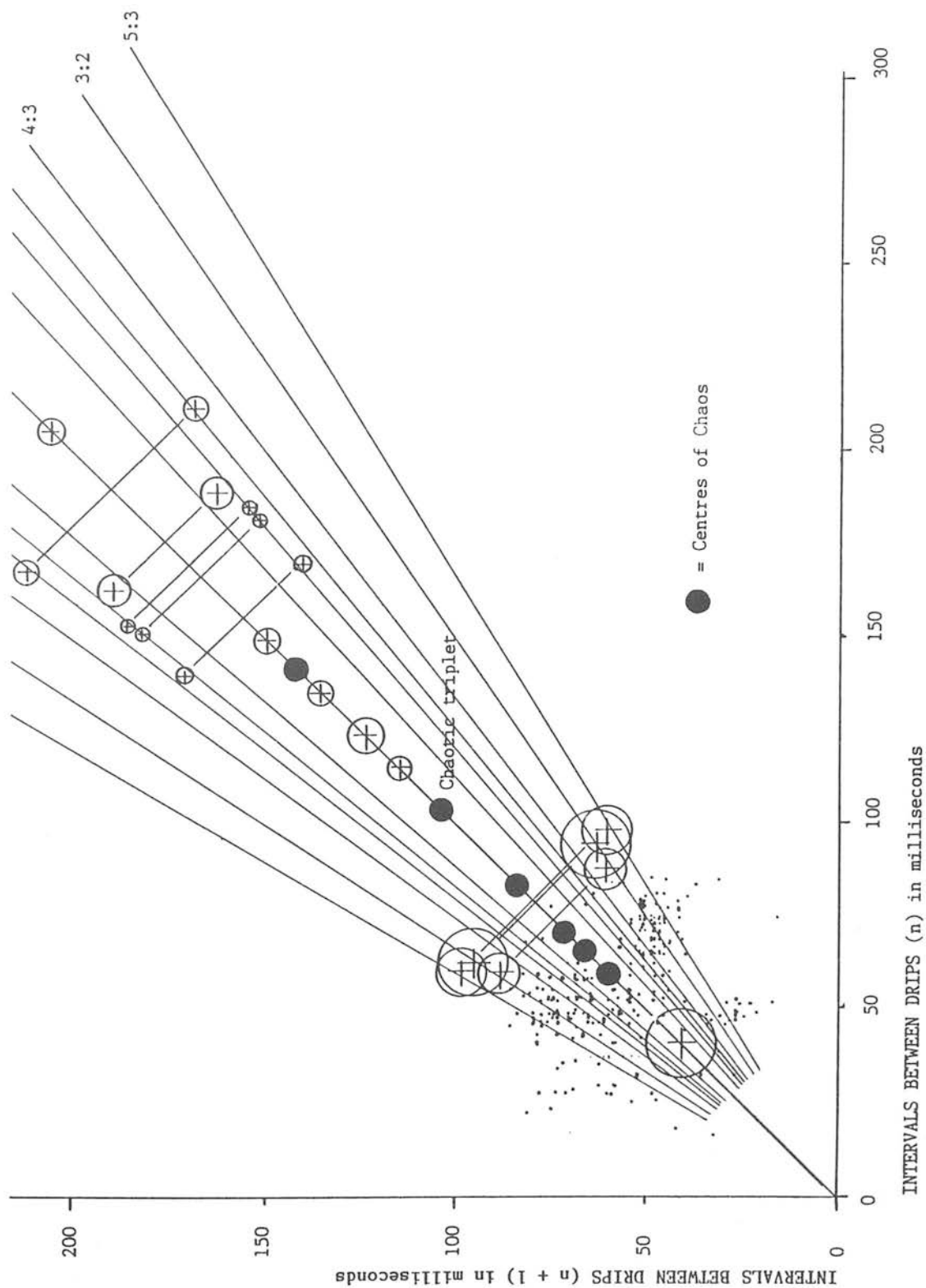


INTERVALS BETWEEN DRIPS (n) in milliseconds - ASYMMETRICAL CHAOTIC TRIPLET centred on 103 milliseconds









of resonances. One of these is shown on page 376: it displays symmetry about a vertical axis, due to the fact that chaos is emerging from a nodal point. Another on page 377, shows two concentrations of points: these reflect the centres of the doublet around which chaos is coalescing. It is claimed that the "smoketrails" represent the topology of an attractor: it may be that they represent the lingering effect of resonances.

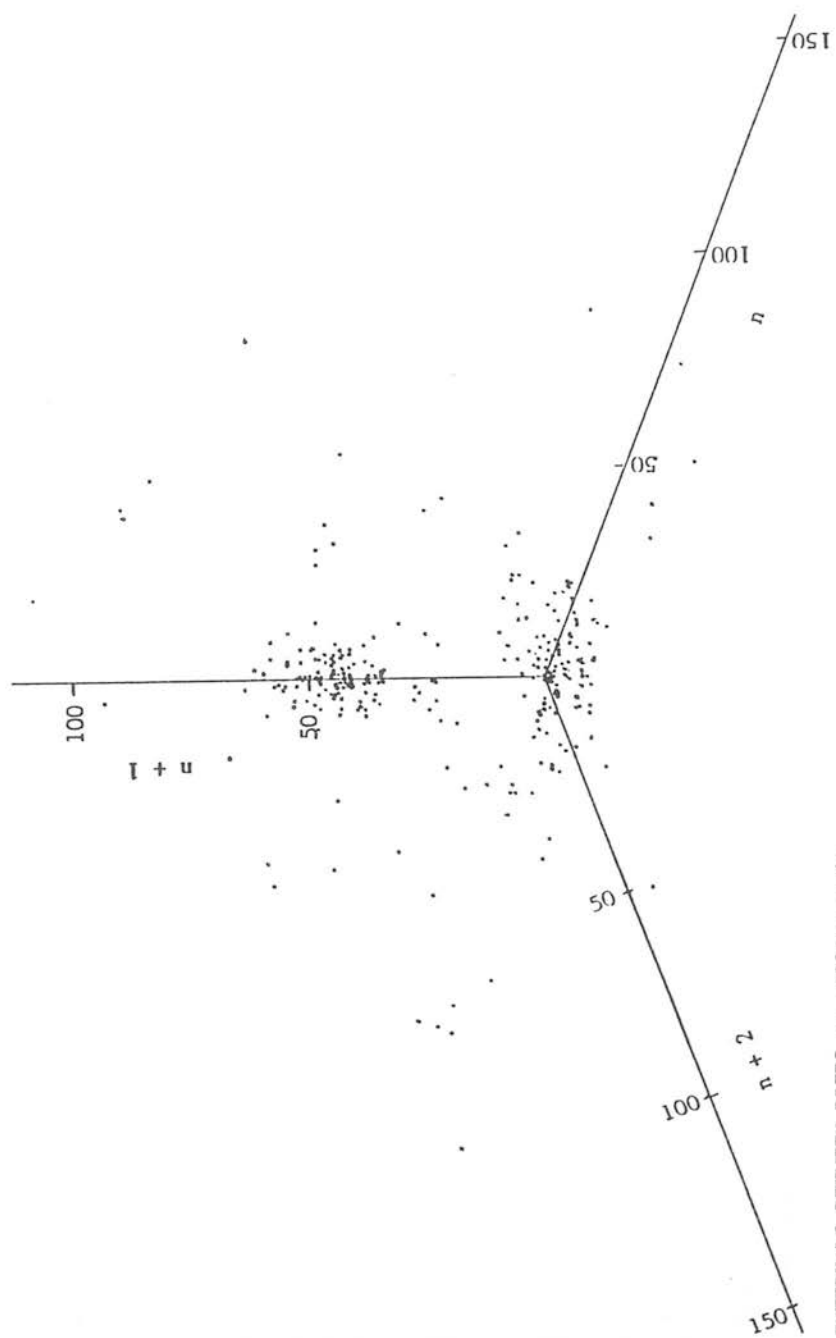
The cumulative sum technique used to express sentence lengths was employed to trace the transitions between modes in the water drip experiment. The graph on page 378 shows the noise element in a periodic drip. Without inaccuracies the periodic drip would give a straight line graph. Page 379 shows a doublet, also with a degree of noise. Page 380 shows the chaotic triplet, and for comparison the iteration of  $X_n = 1.75x^2 - 1$  which yields a mathematical triplet. Many intermediate positions were traced: page 381 shows chaos coalescing on a doublet at 65 milliseconds. In this way it could be seen that a scaling pattern was inherent in the system (page 382), by which the smaller component of a doublet became the basis of the next periodic mode, which in turn provided the longer component for the next doublet. In between each nodal point represented by periodicity or doublet, varying degrees of chaos were combined with the residue of the regular rhythms.

### B.3 Sentence length and Chaos

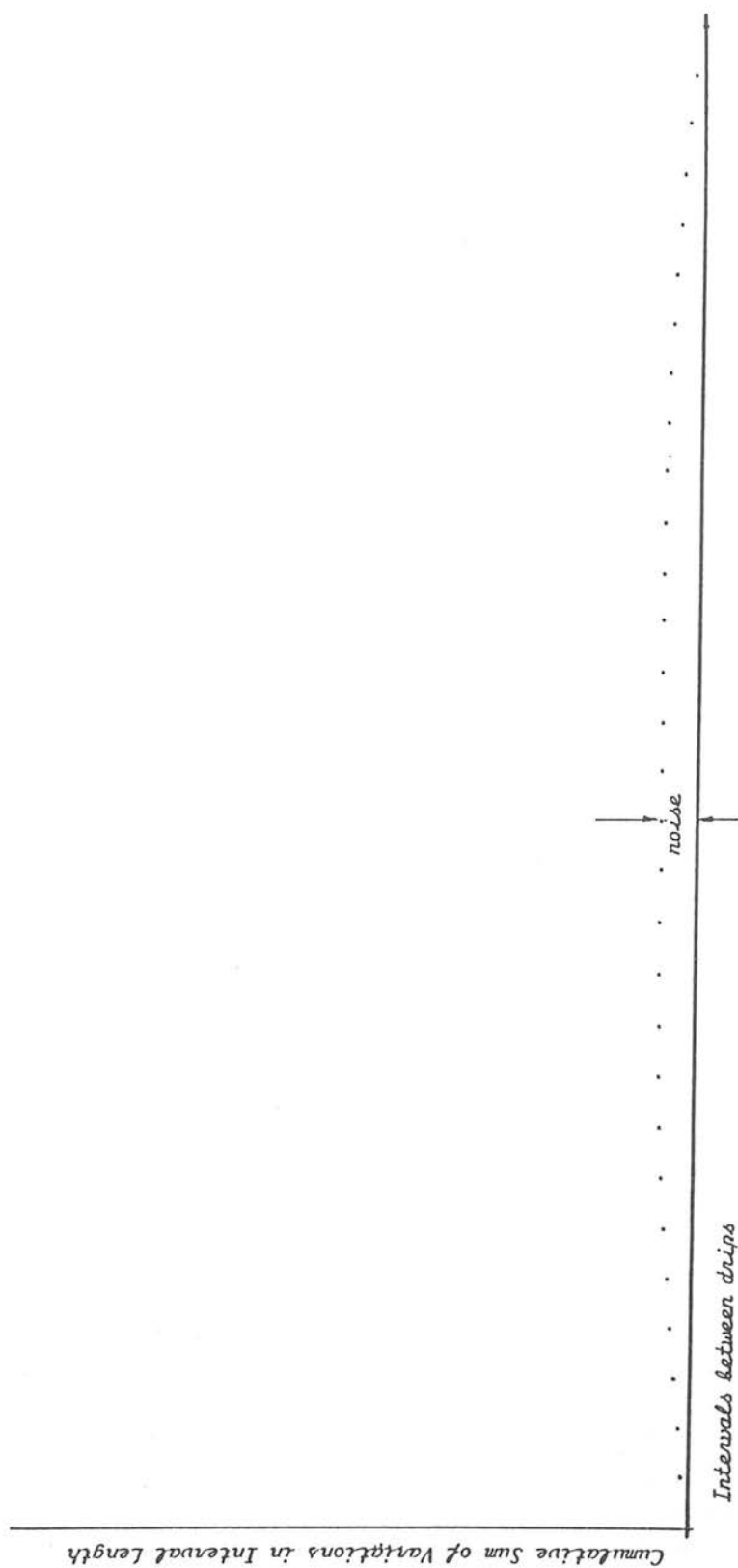
The purpose of this investigation was to determine whether there is an element of chaos in the pattern of sentence sequences which might be compared with mathematical models of chaos. The 3D graphs revealed the precision with which the plots of chaotic sequences drawn from mathematical models fall into place. Plots of sequences from the dripping tap experiment also showed discernible forms but without such precision. Similar 3D plots of sentence sequences were scattered, but it was not clear whether this was because they were exhibiting randomness or chaotic patterns of great complexity. To determine this, a method was devised to obtain a computer printout of the strata of the 3D graphs. Three samples were selected:

1. The iteration of  $1.55x'' - 1$  which provides one mathematical model





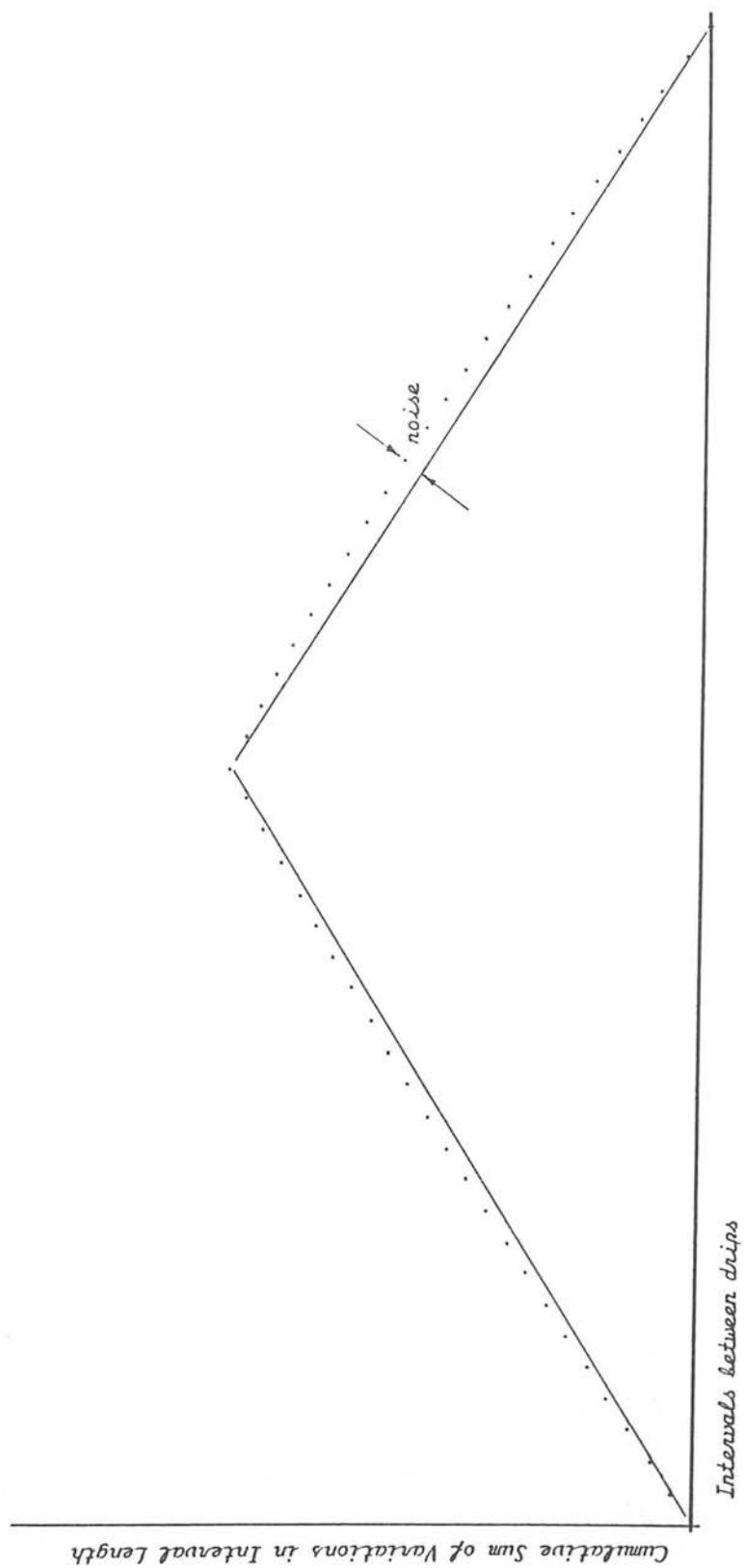
# INTERVAL DISTRIBUTION



Intervals between drips

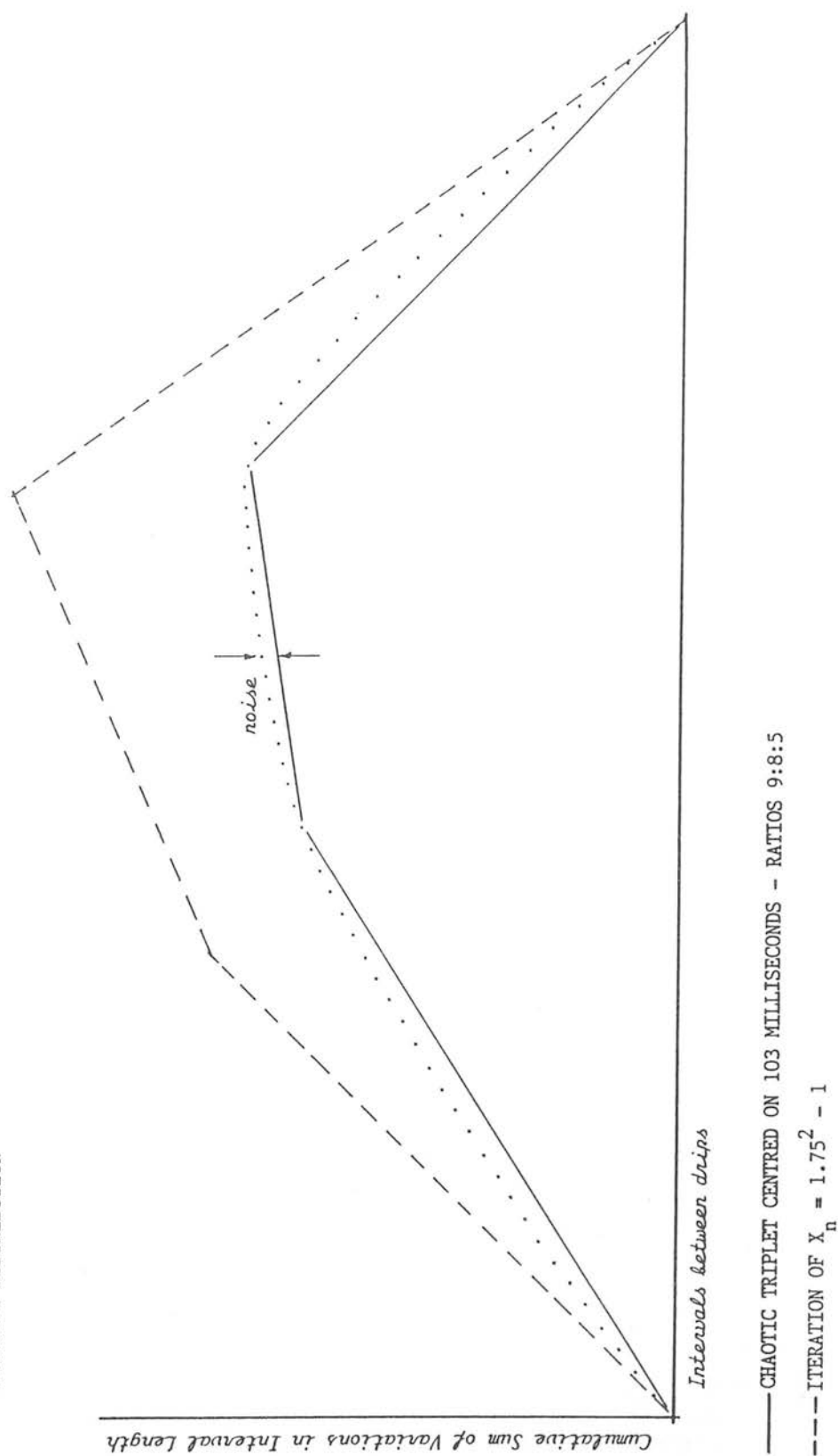
PERIODIC MODE AT 151 MILLISECONDS

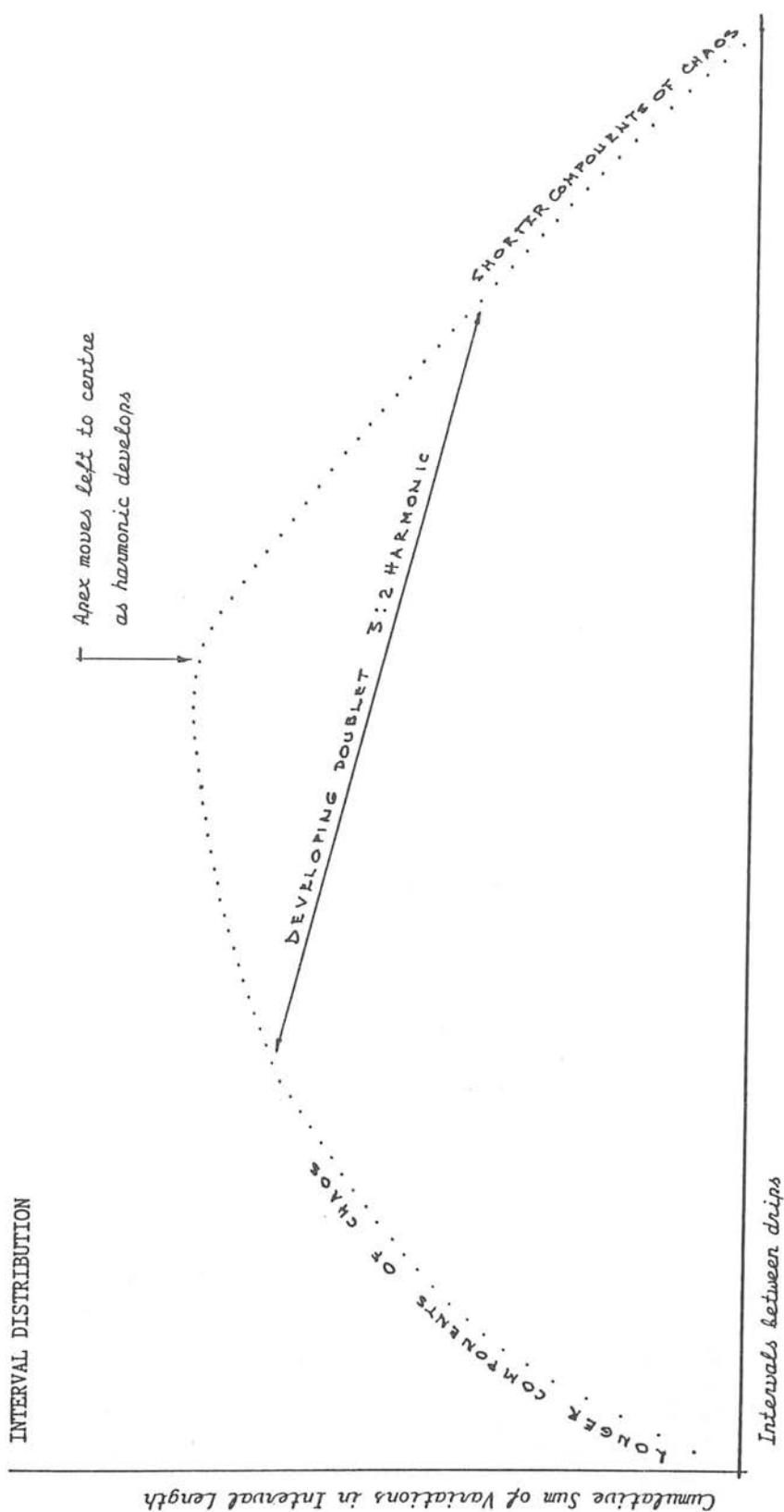
# INTERVAL DISTRIBUTION



DOUBLET CENTRED ON 168 MILLISECONDS - RATIO 6:5

# INTERVAL DISTRIBUTION

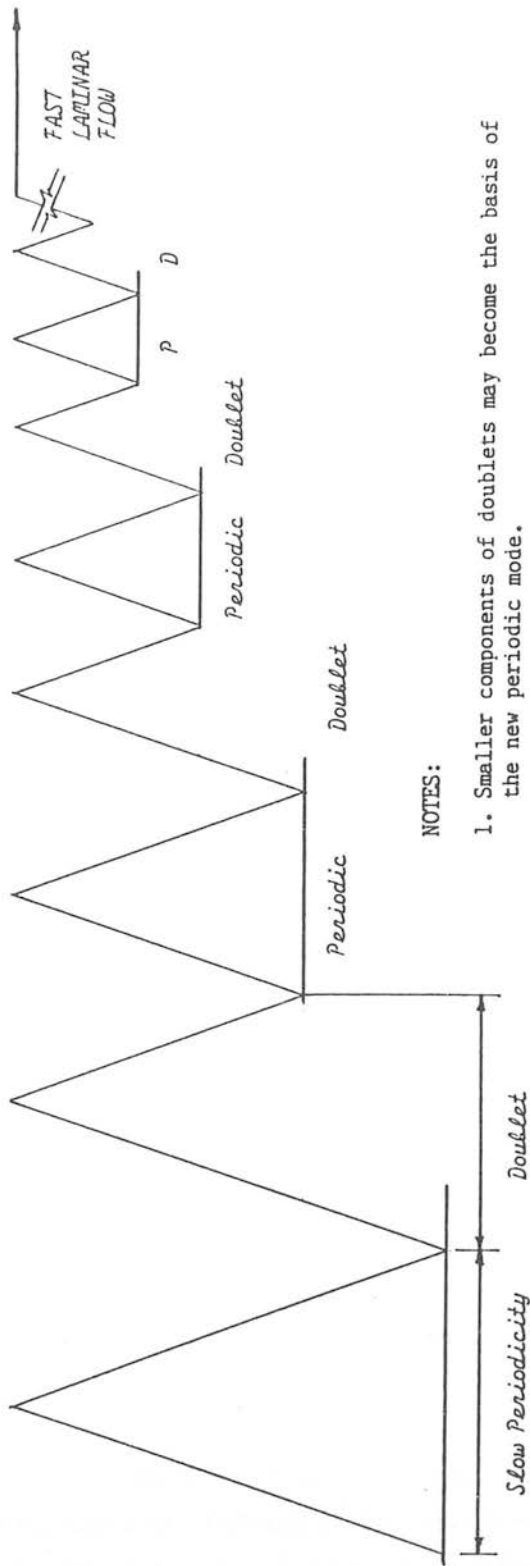




CHAOS COALESCING ON DOUBLET AT 65 MILLISECONDS



DIAGRAM SHOWING SCALING EFFECT IN TRANSITIONS FROM PERIODIC MODES TO DOUBLETS



NOTES:

1. Smaller components of doublets may become the basis of the new periodic mode.
2. Chaos provides the material for the selection of the new component of the doublet.
3. The rate of change in flow determines the harmonic ratio in the new doublet.

of chaos. The graphs of the strata are shown on page 384. This is a precise curve: the irregularities are due to the coarseness of the Minitab grid.

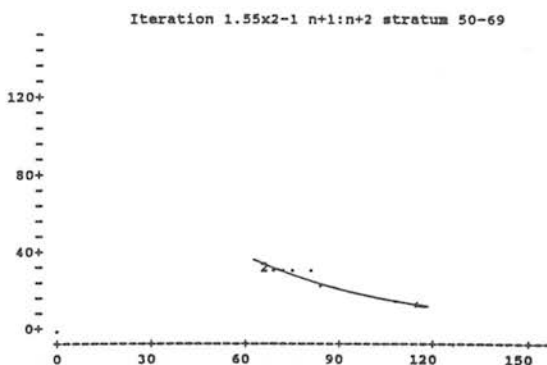
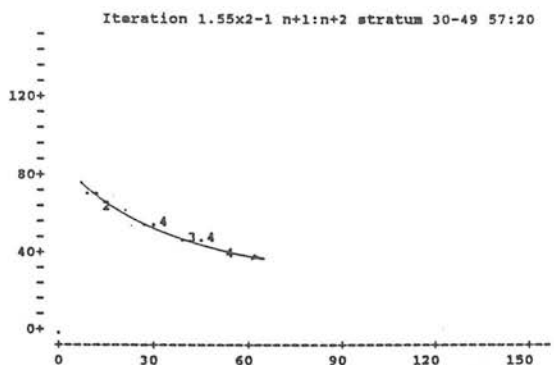
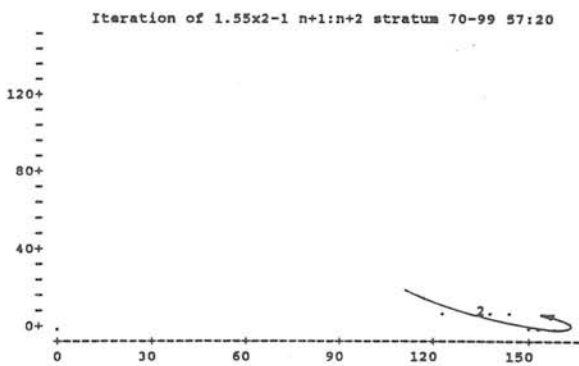
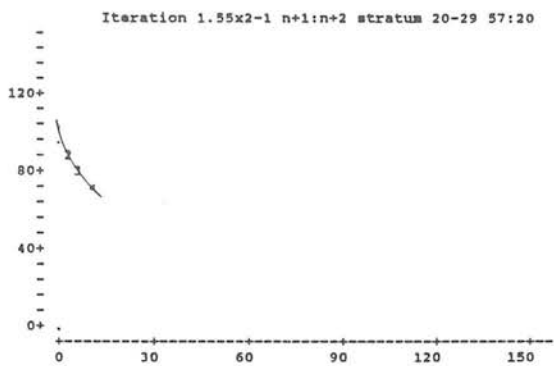
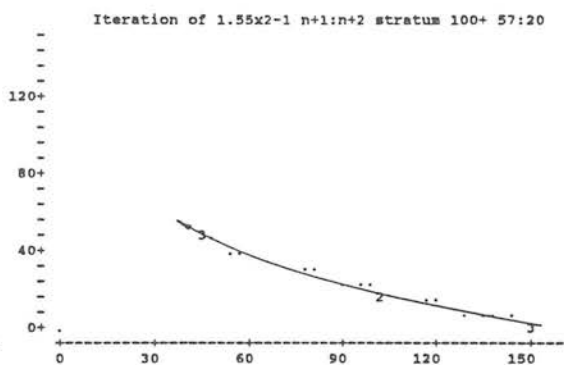
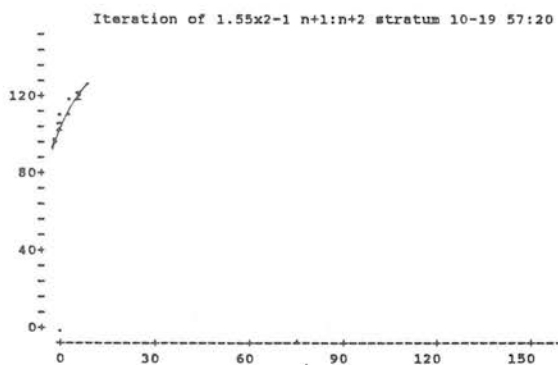
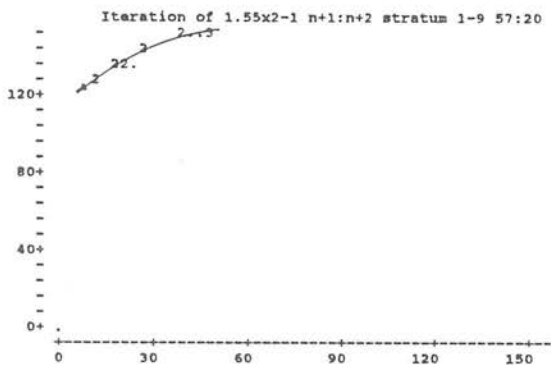
2. A chaotic sequence of intervals from the dripping tap experiment in a transition stage between a doublet and a periodic drip. This shows the residue of a resonance and a concentration on the periodic mode (page 385). The important point is that there is a discernible 3D pattern which is not a random one.

3. The sentence sequence drawn from Isocrates' *Antidosis* which is the longest of his works and provides ample material. The graphs on page 386 show that in every stratum the disposition of the plot is random: there is no discernible pattern and this would indicate that chaos in the mathematical sense is not present.

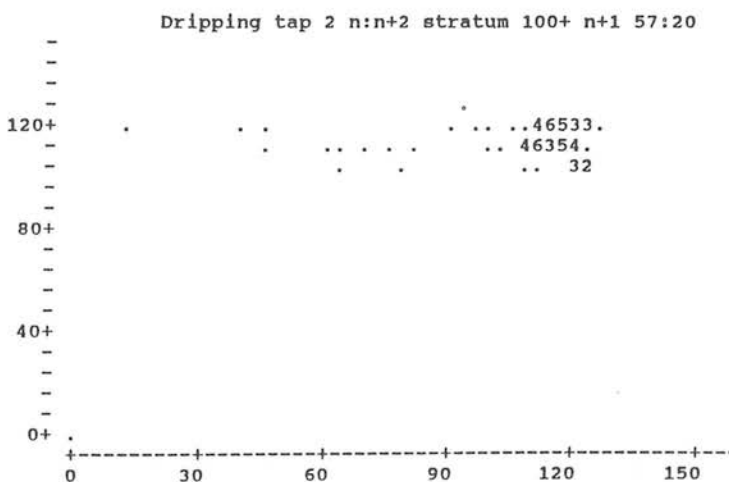
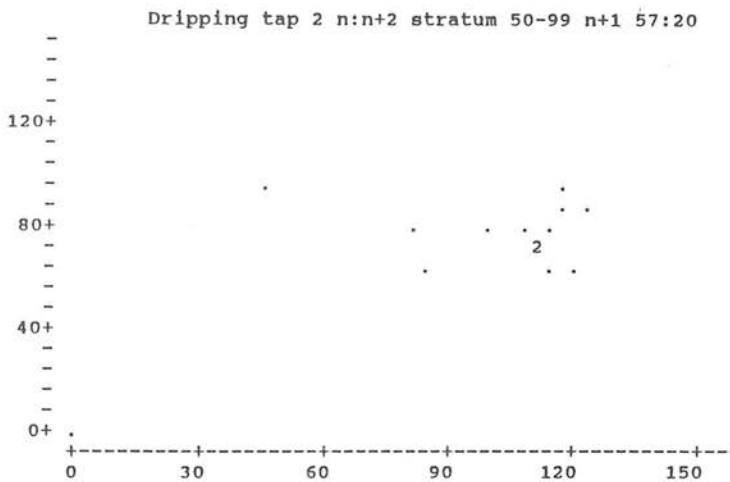
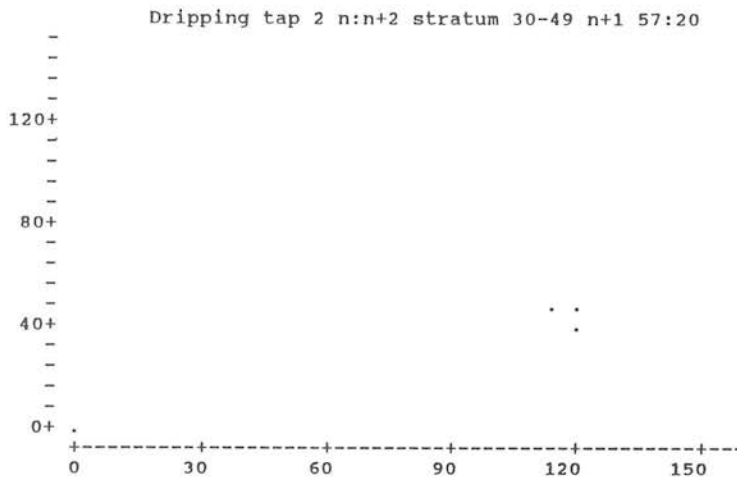
The determinism of the structure underlying the first sample, representing mathematical chaos, seems to be derived from the relationship between numbers and the way they mesh together. Those relationships are unalterable, and in manipulating a formula such as  $1.55x^2 - 1$  there are no external influences. The scaling effect appears to be a function of the way in which numbers interlock. In an experiment such as the dripping tap, it is difficult to achieve the precision found in the mathematical model, but the relationships between numbers tend to appear as resonances producing periodic modes, doublets, triplets etc. and the scaling effect arises out of the relationships between these incidents along the time axis. There does not appear to be any such engine driving the distribution of sentences and to find the cause for scale effects in literature it is necessary to look to differences in genre, subject matter, mood, health, metabolism, numinous awareness etc.

Chaotic sequences can on occasion produce cumulative sum distributions which are indistinguishable from sentence length distributions, yet it is possible for a chaotic sequence to have a virtually normal distribution. In the works covered in these studies, no sentence distribution has been found with symmetrical characteristics.

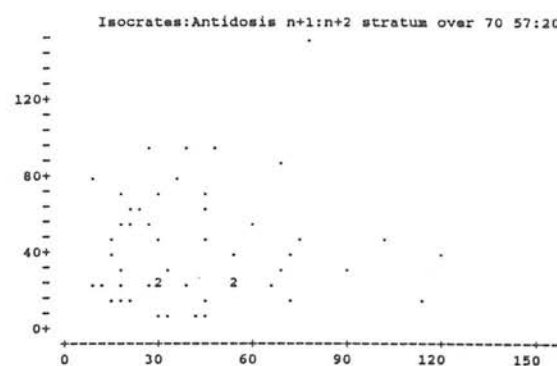
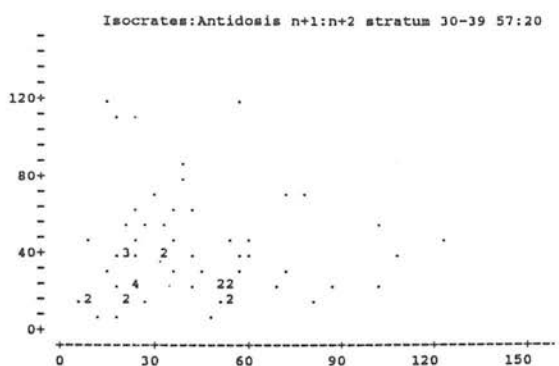
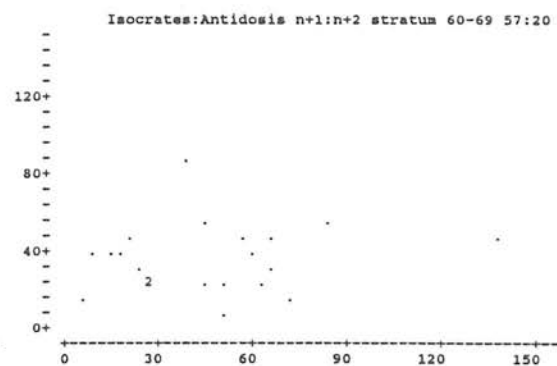
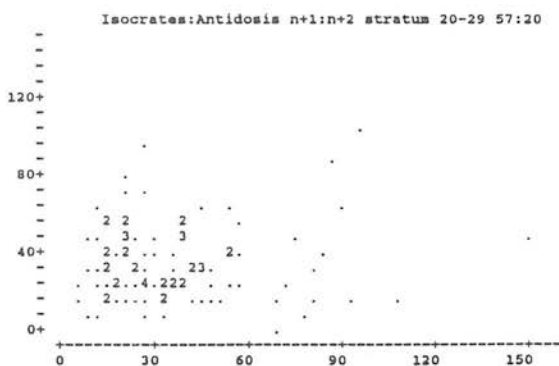
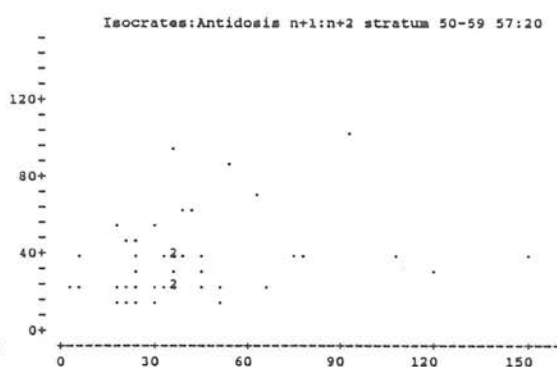
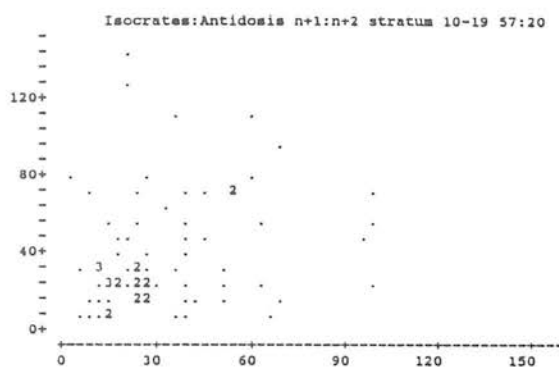
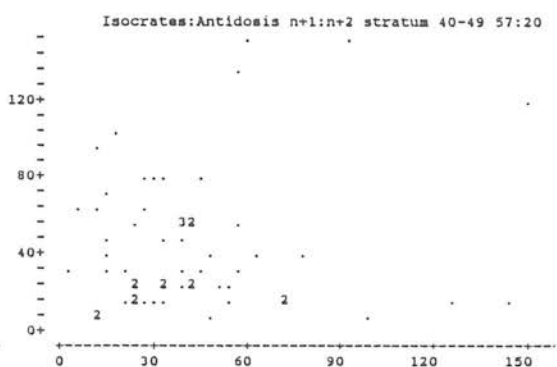
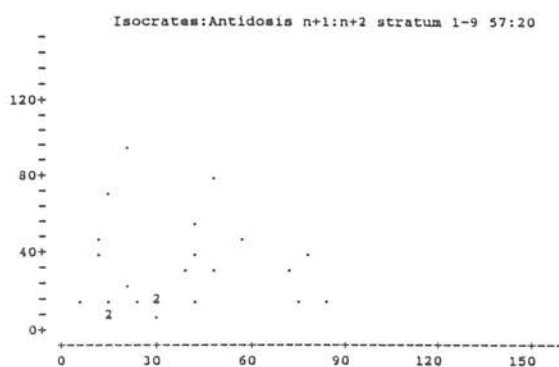
Mathematical chaos is both deterministic and stochastic. The resonances found in the dripping tap were paralleled by instances found in the mathematical model. Sentences sequences show nothing of either that



STRATA OF 3D GRAPH OF ITERATION OF  $X_n = 1.55x^2 - 1$



STRATA OF 3D GRAPH OF WATER DRIP IN CHAOTIC MODE  
NEAR NODAL POINT AT 140 MILLISECONDS



ISOCRATES: ANTIDOSIS

STRATA OF 3D GRAPH

determinism nor any such resonances, but have a different kind of underlying consistency. This is shown in the fact that the cumulative sum graphs of all distributions of sentence length contained in texts of sufficient length, conform to the same family of curves, though showing variation in their proportions and in the proportions of the parent curve from which they are derived.

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